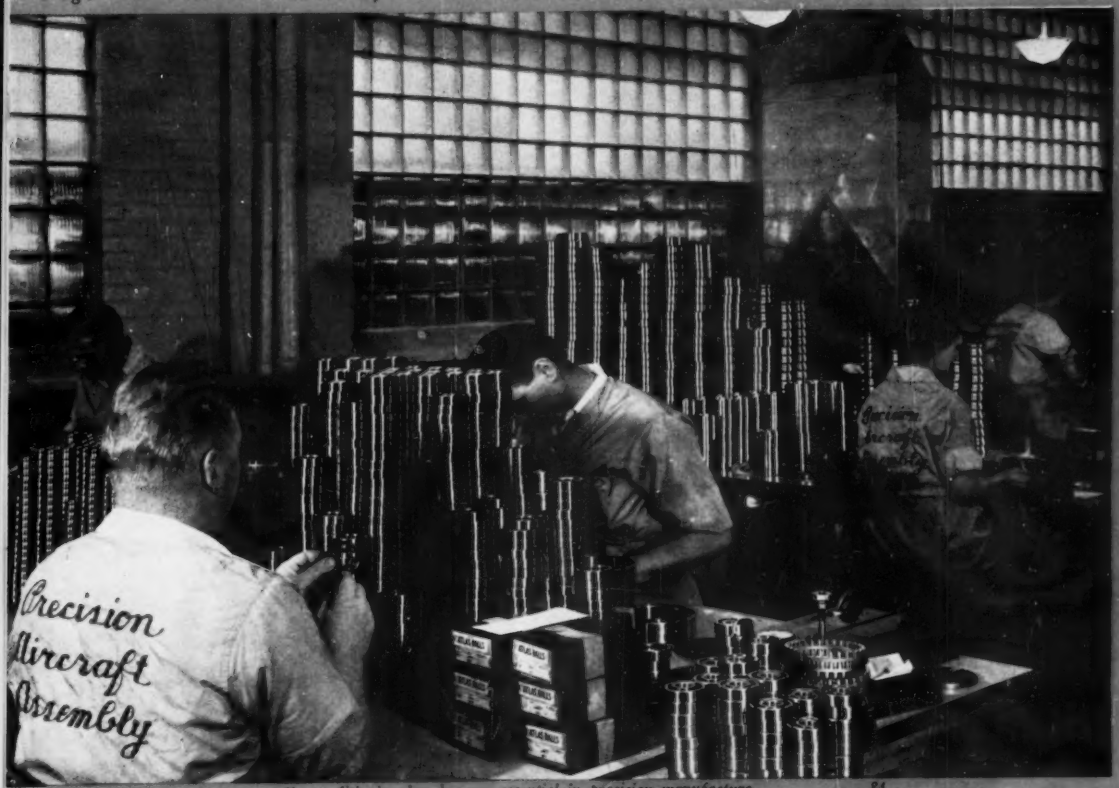
Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

DECEMBER ★ 1952

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

Page 113—Journal Section of The American Society of Heating and Ventilating Engineers



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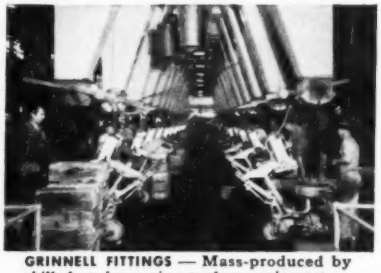
WHY you can depend on GRINNELL PIPE FITTINGS to suit you to a

Superior Quality, Complete Line, Available Coast-to-Coast

The finest materials, equipment and methods are employed in the manufacture of the *complete line* of high quality Grinnell malleable iron and cast iron pipe fittings. Branch warehouses and distributors, located from coast-to-coast, make local stocks as convenient as your telephone.

The same can be said about superior quality and ready availability of Grinnell Steel Nipples. Top grade, new pipe only is used. Controlled manufacture assures accurate chamfer for quick starting; precision threads for easy running-up and tight joints.

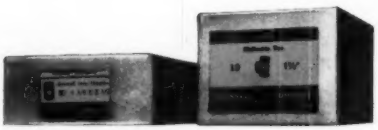


GRINNELL FITTINGS — Mass-produced by skilled workers using modern equipment.

GRINNELL NIPPLES — Precision machines produce accurate threads and proper chamfer.

PACKED IN CARTONS — You are assured easier handling, storage and identification.

When Ordering, Specify Grinnell Malleable Fittings and Steel Pipe Nipples *in cartons* . . .



Both Grinnell malleable iron fittings and steel nipples are available in cartons.* On the shelf or on the job, *cartoned* fittings and nipples offer a number of advantages, at no extra charge:

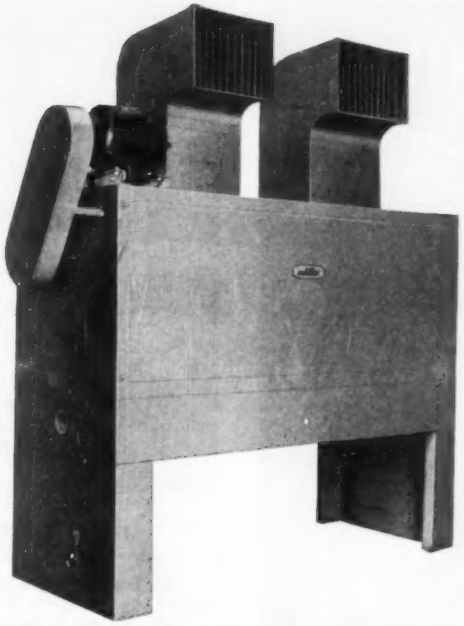
- Faster and cleaner handling
- Cleaner stocks for resale and use
- Threads protected against damage
- Simplified storage and shipping
- Contents quickly identified by labels
- Greater accuracy in filling orders

Grinnell Malleable fittings also come in small and large bags.

Call Your Local Grinnell Distributor

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

Manufacturer of: pipe fittings • welding fittings • forged steel flanges • steel nipples • engineered pipe hangers and supports Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems



Building Block Construction Feature of New usAIRco Heating and Ventilating Unit

Uunlimited number of arrangements possible for floor, horizontal suspended, wall or inverted suspended mounting

The all around adaptability of usAIRco's new Blower Type Heating and Ventilating Unit makes it an ideal installation for warehouses, factories and garages . . . or any type of building where large volumes of air must be heated and distributed uniformly.

Unit may be specified with any combination of the following standard sections: blower, face and bypass, coil, filter and mixing chamber sections.

usAIRco's BH Type Heaters give you greater service at maximum economy because: Blower Section has forward curved centrifugal blowers for high efficiency and noiseless operation; Coil Section is of heavy gauge steel, and can be turned end for end to fit any problem. Hot water, steam, or steam distributing tube coils are available. The completely sectional construction means easy installation, trouble-free maintenance.

The new usAIRco BH Type Units are available in 8 sizes: 1000 to 33,000 CFM.

See your nearest usAIRco agent or write to Dept. HP 122

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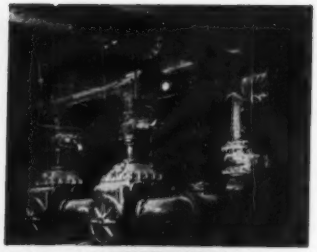

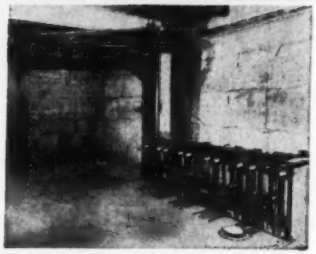

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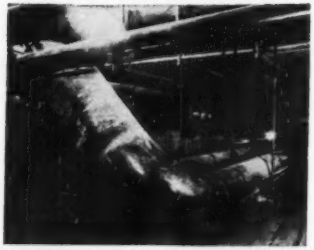

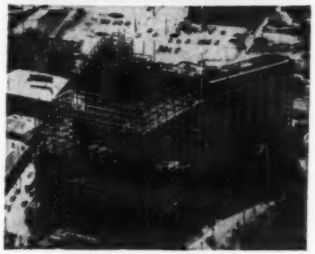

The selective use of Byers Wrought Iron pipe in the new Statler Center, Los Angeles, owned and operated by Hotels Statler Company, Inc., New York, amply supports the careful planning that was given to maintenance control in this ultra-modern structure. Over 215 tons of this time-tested material was installed for steam returns, brine lines, chilled water lines 4" and larger, blow-down discharge lines, soil, waste and vents above ground, hot, cold and ice water piping 4" and larger, vacuum cleaning system, soap dispensing system and the air conditioning system.

Every one of these services carry a corrosive threat . . . and every one represents a time-tried genuine wrought iron application. The material's proved ability to last longer, at lower cost per year, is providing an increasing number of leading engineers with a reliable guide to material selection in today's modern building.

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ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS

Heating Piping & Air Conditioning

Vol. 24 No. 12

(with which is merged the Aerologist)

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304
The FLOWLINE Tee
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If you are not using FAR-AIR* filters – you may be paying 33⅓% too much for air filtration!

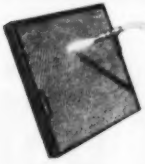
HERE'S WHY...

FAR-AIR filters with their many exclusive design features are the first and original high velocity air filters. Each unit is engineered to hold *more* dirt, handle *more* air with *less* pressure loss and give *greater* efficiency than other impingement filters. This means that your maintenance and installation costs are drastically reduced—so much so, that it probably will pay you to replace your present filters with FAR-AIR.

1/3 SPACE SAVING

Because these filters handle 50% more air per unit with less pressure loss, two FAR-AIR filters will do the work of three ordinary types. You make substantial savings in first cost through smaller plenum chambers and fewer filters and holding frames.

CUT MAINTENANCE UP TO 60%



FAR-AIR filters hold more dirt per unit without decreased efficiency, so maintenance is cut approximately ⅓. Also, due to the media design, they can be cleaned by simply flushing with a hose. *These filters can even be cleaned and reoiled without removing them from the filter bank!* All these points add up to less maintenance time and cost than you would believe possible.

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Extra quality in construction allows these filters to far outlast ordinary types. Sixteen gage steel filter and holding frames assure well-aligned, rigid filter banks. Reinforcing rods drilled through the media make distortion virtually impossible. Felt linings prevent air bypass. Firmly packed media provides even density and assures uniform high efficiency over the entire filter area.

EXCLUSIVE PROGRESSIVE LOADING FEATURE GIVES YOU MORE EFFICIENT FILTERING

The famous herringbone-crimp design of the media allows the filter to load with dirt progressively through the entire filter, not just on the face. There is exceptionally low pressure loss even on a fully loaded filter because channels in the media allow passage of air. You get more efficient filtering over a longer period of time as a result.

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KITCHEN GREASE ELIMINATORS
ENGINE AND COMPRESSOR FILTERS
ROTARY (EVAPORATIVE) COOLERS
AIR BAFFLE EQUIPMENT
FILTER SERVICING EQUIPMENT

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Mail the coupon, today!

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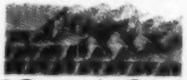
FAR-AIR FILTERS



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Gentlemen: Please send me complete information on FAR-AIR filters. I ☐ would ☐ would not like a Farr Field Engineer to assist me with my filter problems.

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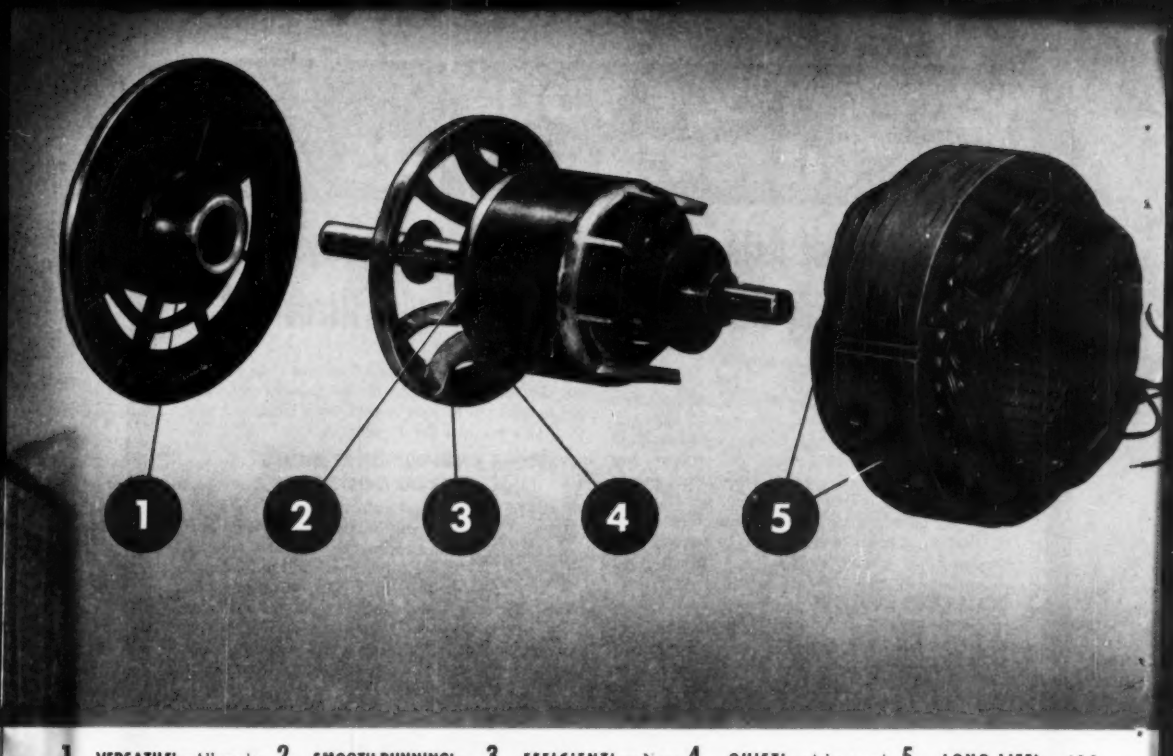

1. VERSATILE!—All-angle bearing and lubrication system permits motor to operate in any position.

2. SMOOTH RUNNING!—Precise rotor balancing and concentricity of rabbets and bearings.

3. EFFICIENT!—New electrical design, ventilation give top performance in least space.

4. QUIET!—Advanced magnetic design and unitized rotor-fan casting provide quiet operation.

5. LONG-LIFE!—*ALL* synthetic insulation resists moisture, corrosion and electrical breakdown.

Ten good reasons for using

Above you see ten good, basic reasons for using the all-new G-E "form G" motor—right now! And at your right are four big "plus" reasons perhaps even more important to you.

Completely different . . . completely *functional* . . . this general-purpose motor gives you full NEMA performance plus up to *50% less weight, 40% less bulk—rating for rating!*

You get efficiency, sturdiness, extra long life . . . *plus quiet, all-angle operation in every rating!*

Now you can improve your product, speed assembly time, cut your handling and shipping costs.

Want more good reasons for using this new motor? Contact your nearest G-E Apparatus Sales Office or write for bulletin GEA-5567. Address Section 700-121, General Electric Co., Schenectady 5, N. Y.

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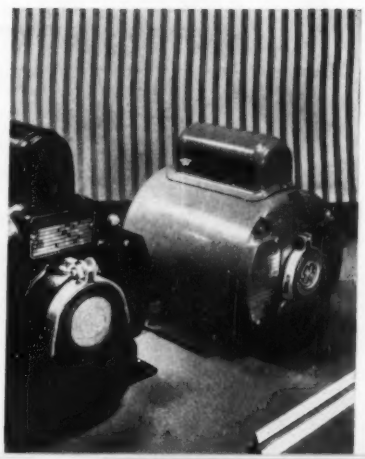

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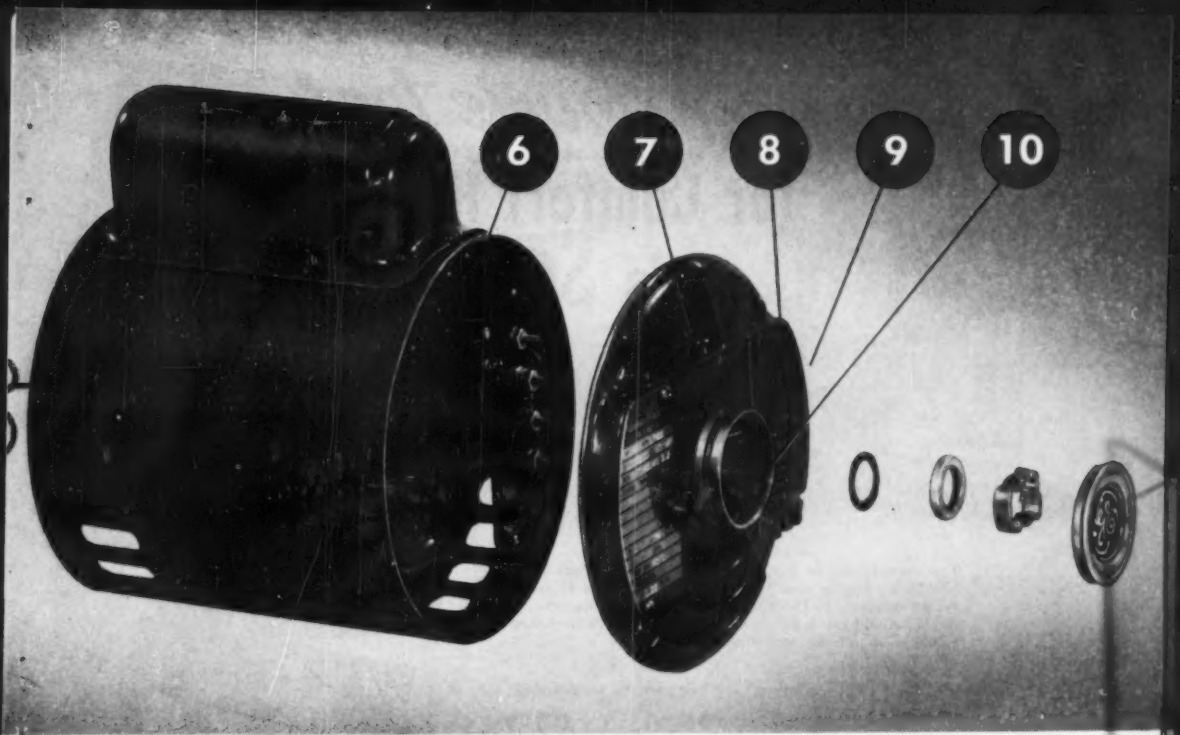


6. STURDY!—Another G-E innovation: shell is expansion-fitted to stator: a strong *unit* assembly.

7. LESS MAINTENANCE! Spacious oil reservoirs—no lubrication required on some applications.

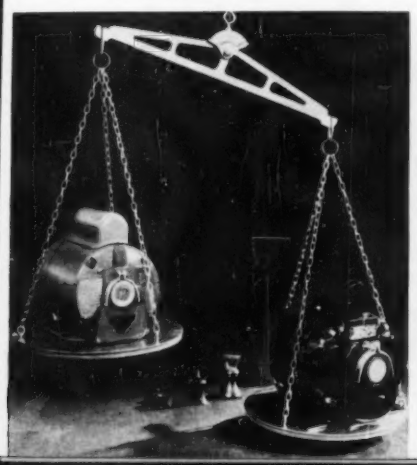
8. CONVENIENT!—Roomy terminal box—cover has connection and lubrication instructions.

9. RIGID!—This motor has strong, lightweight aluminum end shields especially rib-reinforced.

10. FLEXIBLE—Cradle bases—*solid* or resilient—facilitate easy mounting in any position.

the all-new G-E Fhp motor!

LIGHTER . . . ***BETTER LOOKING . . .*** ***MORE VERSATILE!***



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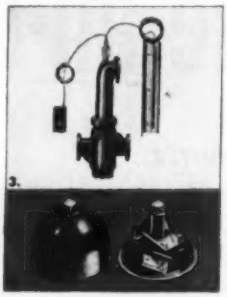


3. The heart of the Sarcotherm control system for radiant or forced hot water heating is this unique control valve. It is actuated by liquid expansion thermostats, one located outside the building and one in the valve itself. Between them they anticipate changes in heat loss ratio, thus maintaining comfort temperatures under all conditions.
4. The Sarcotherm Comfort Control "Thermoray" is an extremely sensitive thermostat affected by both radiation and convection.

SARCOTHERM CONTROLS, INC.

Empire State Bldg., New York 1, N. Y. • Represented in principal cities

A SARCO PRODUCT

23

CONTRACTORS SELECT

SARCO

for

NEW JERSEY

TURNPIKE

SARCO is proud to have a part in this monumental achievement of public service.

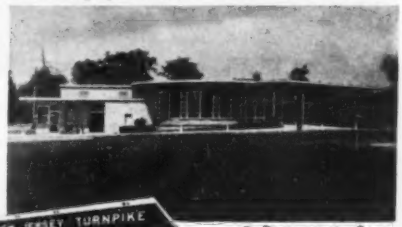
As you drive along this six-lane superhighway, without grade crossings, running from below Wilmington, Del., to the George Washington Bridge, you pass 36 different Turnpike structures. Each one is equipped exclusively with Sarco Heating Specialties.

More than 2100 Sarco products of the types shown below were selected by Heating Contractors A. A. La Fountain Inc., and August Arace & Sons Inc., both of New Brunswick, N. J.

For full information write for the Sarco Heating Bulletins.

Sarco Company, Inc., Dept. 407, Empire State Bldg., New York 1, N. Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ontario

● New Jersey Turnpike Administration Building at New Brunswick, N. J. Everyone of 36 Turnpike buildings is 100% equipped with Sarco Heating Specialties.



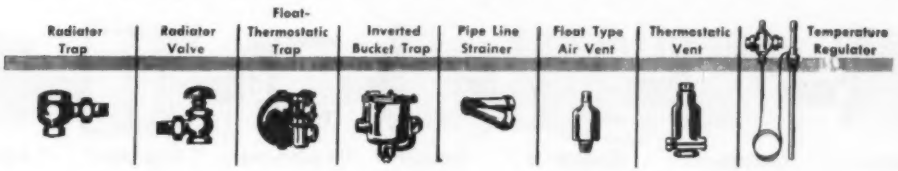
● Restaurant—Service Bldg. on New Jersey Turnpike. More than 2100 Sarco Heating Specialties are used in the 36 Turnpike buildings.

● One of the 20 steam heated Toll Booth-Utility Buildings. Only Sarco Heating Specialties are used.

SARCO saves steam

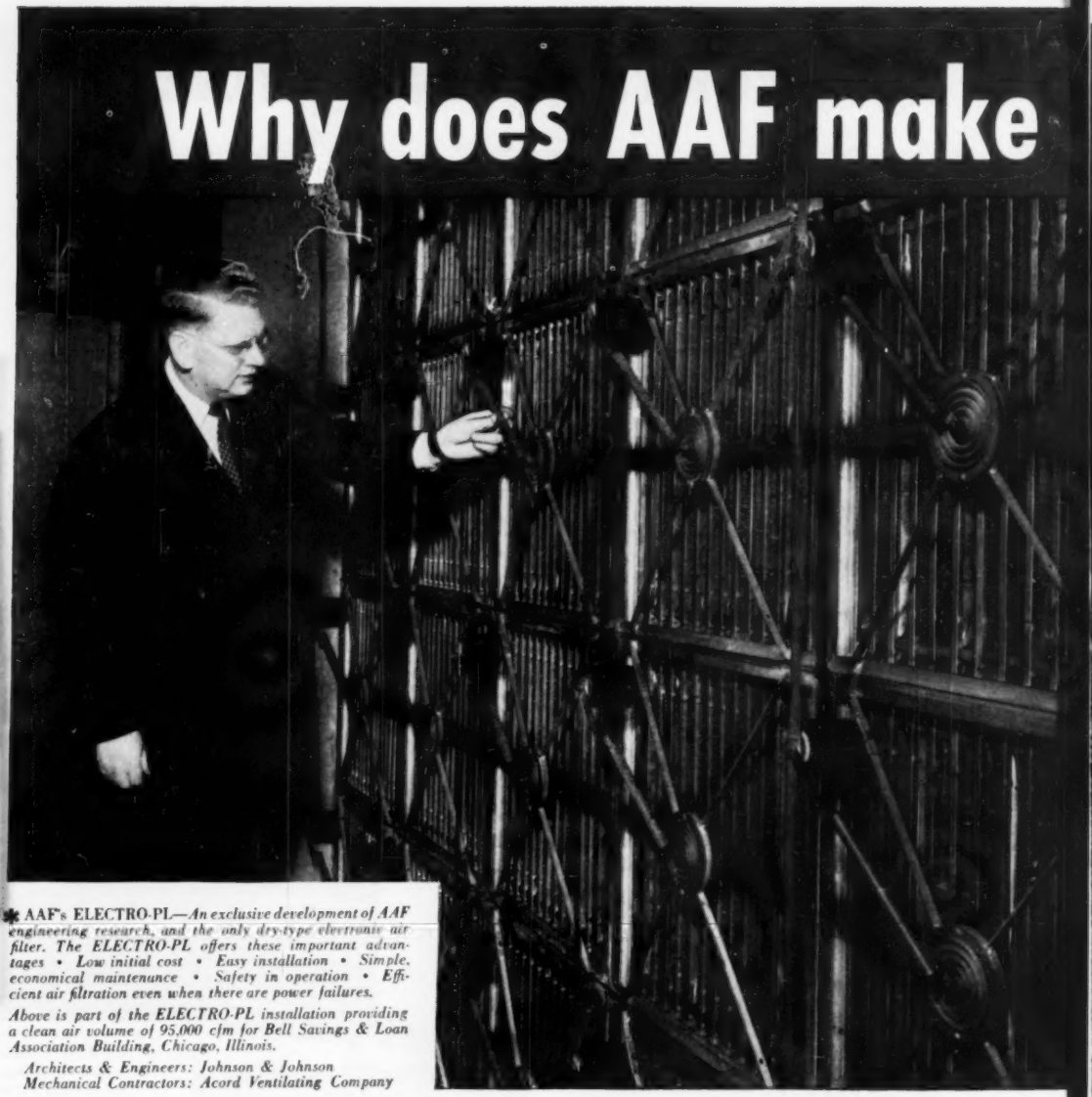
sarco quality assures satisfaction

Over 2,100 of these Sarco Heating Specialties are installed in the 36 New Jersey Turnpike Buildings.



407

Why does AAF make

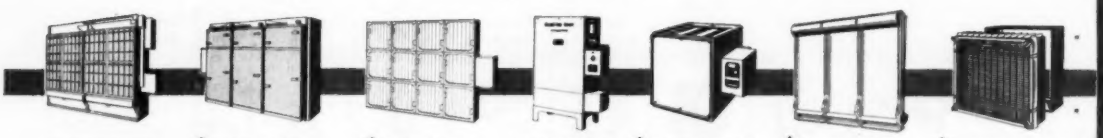


✱ AAF's ELECTRO-PL—*An exclusive development of AAF engineering research, and the only dry-type electronic air filter. The ELECTRO-PL offers these important advantages • Low initial cost • Easy installation • Simple, economical maintenance • Safety in operation • Efficient air filtration even when there are power failures.*

Above is part of the ELECTRO-PL installation providing a clean air volume of 95,000 cfm for Bell Savings & Loan Association Building, Chicago, Illinois.

Architects & Engineers: Johnson & Johnson
Mechanical Contractors: Acord Ventilating Company

a single source for all air cleaning equipment . .



ELECTRO-MATIC ✱ ELECTRO-CELL ✱ ELECTRO-PL ELECTRO-MIST ✱ ELECTRO-KLEAN ✱ AUTO-AIRMAT ✱ AIRMAT PL-24

8 dry-type* air filters?

THE answer is simple, but *important* to all Engineers and Executives responsible for air cleaning applications. AAF's eight different dry-type air filters were specially designed to meet the complex combination of factors that faces the engineer in solving dust and air contamination problems. Years of experimental work and thousands of individual installations have proved that at least six basic types are necessary to allow adequate latitude in specification, and to meet job requirements both practically and economically. Today, AAF's dry-type filters provide a wide range of operating and maintenance characteristics — from the AUTO-AIRMAT (fully automatic and self-cleaning) to simple replaceable units.

AAF's eight types of dry filters offer the engineer maximum flexibility in combining the following factors to fit specific job requirements:

- Cleaning Efficiency
- Maintenance Methods
- Space Requirements
- Sizes and Air Volumes
- Practical and Realistic Range of Costs

In addition to a complete line of air cleaning equipment AAF also offers the services of a nationwide engineering staff, which is recognized as the leading authority in this field. The specialized knowledge of these experts can save you time, effort and expense and is at your disposal.

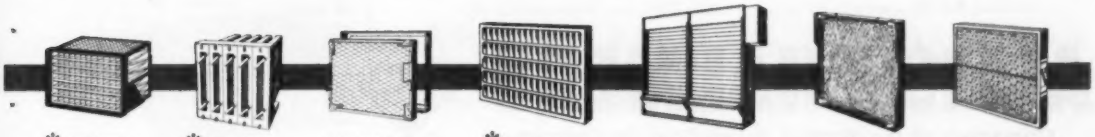
Complete engineering data is available on all AAF equipment. Contact your nearest AAF representative or write direct to us.

American Air Filter
COMPANY, INC.

373 Central Avenue, Louisville 8, Ky.

AMERICAN AIR FILTER OF CANADA, LTD., MONTREAL, P. Q.
PACIFIC DIVISION OFFICE, SAN FRANCISCO, CALIFORNIA

®AAF



*DEEP-PAK | *DEEP BED | M/W-H/V UNITS | *DRIFILTER | MULTI-DUTY | RENU-GLAS | AMER-GLAS

Let one sheave do the job of 2 or 3!

WHY DISMANTLE DRIVES and change sheaves every time fan speed must be changed? Get the speed you need with one *Vari-Pitch* sheave.

Saves contractor's time engineering and balancing the system. Saves user's time making seasonal changes in air flow.

In addition:
- ✓*Vari-Pitch* drives are quiet.
- ✓They provide infinite number of speeds.
- ✓Speed of fan will not change once it's set.
- ✓*Vari-Pitch* drives cost less than other methods of speed changing, such as multi-speed motors, or special control.

GO TO V-BELT DRIVE HEADQUARTERS

Allis-Chalmers offers these services:

1. A wide choice of variable speed sheaves.
2. Help to the equipment manufacturer in engineering the drive.
3. On-the-spot help for the contractor.
4. All the equipment and engineering needed for the complete drive including: sheaves, belts, motors, starters, and motor bases—all from one reliable source, backed by nation-wide service.

Call your nearby Allis-Chalmers distributor or district office, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3766

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Distributors, Certified Service Shops and Sales Offices throughout the country.

MOTORS — ½ to 25,000 hp and up. All types.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

ALLIS-CHALMERS

Originators of the Multiple V-belt Drive for Industry

Texrope and *Vari-Pitch* are Allis-Chalmers trademarks.

These are customers!

Sidewalk snow melting helps keep them

. . . and brings more

Sooner or later, *whatever* the business, a "buyers market" *will return.* When it does . . . and for some it already *has* . . . competition will again reign as "the life of trade."

It may then be that so little a thing as a friendly smile or a considerate way of dealing will react favorably. Certainly the *bigger* things like making it easy, convenient, and comfortable to transact business will help keep present customers and attract new ones.

So, for good business reasons many merchants, bankers, hotel, apartment and office building owners, and others are installing sidewalk and parking area snow melting systems. As *sales builders* such systems rank with air conditioning, good lighting and modern rest rooms.

You can be sure when you specify steel pipe, that it is the *first choice* for such installations. For steel pipe is economical, formable and weldable for coil and grid fabrication, and has been proved in more than 60 years of conventional hot water and steam heating applications. In fact, for snow melting and other applications, steel is the most widely used pipe in the world!

Steel Pipe is First Choice

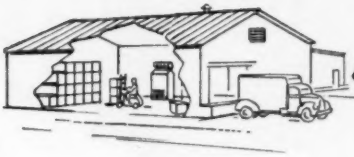
COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N.Y.

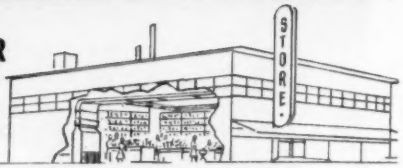
DRAVO *Counterflo*

A POSITIVE *SOLUTION* FOR



1. INDUSTRIAL CENTER

Where space is limited or roof heat losses are unusually high, Dravo Heaters require minimum space . . . no expensive boiler plant; roof heat losses low due to controlled recirculation of air; can be used with or without ducts.



3. SUPERMARKET

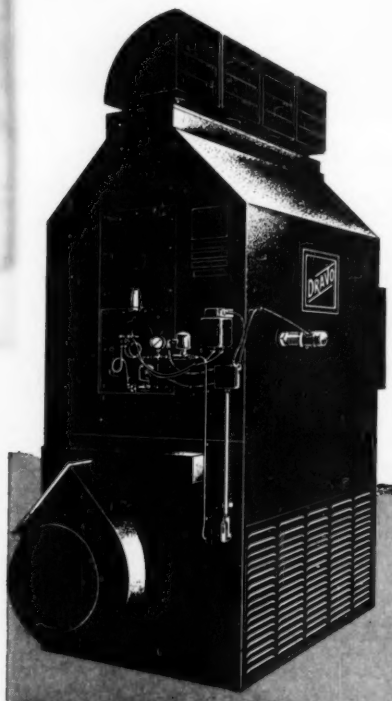
In heating, ventilating and air conditioning large areas, Dravo Heaters can tie in with air conditioning system by using same duct work, provide year-'round comfort.

2. FOUNDRY

Negative pressures, caused by exhausting foul air, are balanced by tempering fresh outside air with Dravo Heaters. Atmosphere is kept healthy, constant temperatures are maintained, worker efficiency improves.

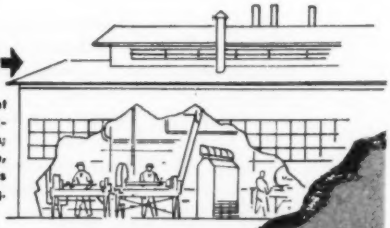
4. MEDIUM-TEMPERATURE CURING

In controlling temperatures and air moisture content in process manufacturing, Dravo Heaters have automatic controls, maintain constant temperature, can recirculate air to control curing process.



5. MACHINE SHOP

For comfort heating large plant areas, Dravo Heaters have maximum air throw in all directions; can be turned off during idle time, warm up quickly, keep fuel costs low, can heat 4,000 to 20,000 sq. ft. area, no duct work required.



Approved by American Gas Association

Listed by Underwriters' Laboratories, Inc.

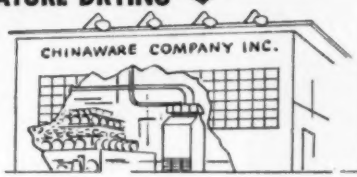
ACCEPTANCE BY FACTORY MUTUAL ENGINEERING DIVISION OF DRAVO STANDARDIZED SAFETY CONTROL CIRCUIT.

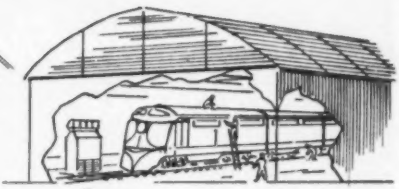
HEATERS.....

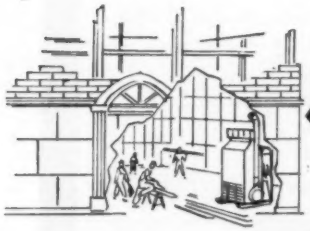
8 DIFFERENT HEATING PROBLEMS!

6. MEDIUM-TEMPERATURE DRYING

In removing moisture in drying operations, Dravo Heaters provide low-cost heat at even, predetermined temperatures; are automatic in operation, can use gas or oil, are readily converted.







7. TEMPORARY HEATING

For building construction projects where ground temperature must be kept above freezing, Dravo Heaters are quickly installed, easily moved to any location; can be later used as permanent heating plant for the new building.

8. RAILROAD REPAIR SHOP

In providing ample heat for repairmen in large buildings, Dravo Heaters keep heat where it's needed . . . at the working level; directional nozzles easily adjusted to suit conditions; heaters can be mounted on walls or hung from ceiling in any position.

DRAVO *Counterflo* HEATERS CAN SOLVE SIMILAR PROBLEMS IN THESE INSTALLATIONS, TOO

Comfort Heating and Ventilating in schools, churches, auditoriums, laundries, restaurants, garages, factories.

Process Drying of wood, rubber and paint; rug drying; auto laundry operations.

Process Curing of concrete pipe linings, farm crops, paper and fibres.

DRAVO HEATERS OFFER YOU . . .

- Low initial cost—users report 30% to 60% savings.
- Easy installation—electrical, fuel and exhaust connections are only requirements.
- Flexibility—where floor space is limited, can be wall-hung or suspended from trusses.
- Low fuel cost—direct-fired . . . burn gas or oil . . . units readily converted.
- Automatic operation—on-off or modulating controls.
- Long service life—stainless steel combustion chamber eliminates refractory lining . . . low maintenance costs.

MAIL THIS COUPON FOR MORE INFORMATION . . .

Heating Department
Dravo Corporation
Dravo Building, Fifth and Liberty Avenues
Pittsburgh 22, Penna.

☐ Please send me Bulletin No. TU-52 -1324
☐ Please have a representative call.

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____

DRAVO

CORPORATION

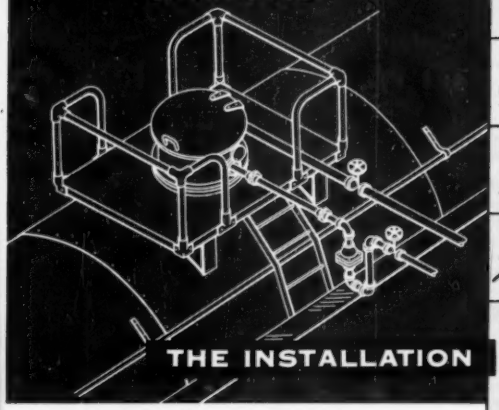
PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CLEVELAND
DETROIT • NEW YORK • PHILADELPHIA

Sales Representatives in Principal Cities

Manufactured and sold in Canada by Marine Industries, Ltd., Sorel, Quebec. Export Associates: Lynch, Wilde & Co., Washington 9, D.C.

Are Your Check Valves Cutting Costs This Way?

...on Corrosive Fluid for instance



THE INSTALLATION

Crane Steel Vertical Ball Lift Check Valve in air pressure line to chlorine tank car, The Mead Corporation, Chillicothe, Ohio.

VALVE SERVICE RATINGS

SUITABILITY:	Doing what's needed
FEATURES:	Non-sticking ball disc
CORROSION-RESISTANCE:	Shows no effects of chlorine
SERVICE LIFE:	Still O.K. after 3 years
MAINTENANCE COST:	Zero – valve never out of service
OPERATING RESULTS:	No loss of chlorine – no unloading delays
AVAILABILITY:	Regular Crane product

THE HISTORY

Unloading chlorine tank cars by pressurizing is common practice. But, formerly, it wasn't safe for this mill. When the compressor was shut down, chlorine would back up into the air system.

Corrosion product would form on the working parts of the check valve in the air line. The disc would stick in open position, letting the chlorine back up. This meant frequent dismantling of the check for servicing. It meant a lot of extra cost in time, labor and unloading delays.

But the trouble was stopped with a Crane Steel Vertical Lift Check. Its polished ball disc of solid Exelloy doesn't stick; always seats tight. For more than 3 years this check has never failed to stop backflow, and still it's good as new.

THE VALVE

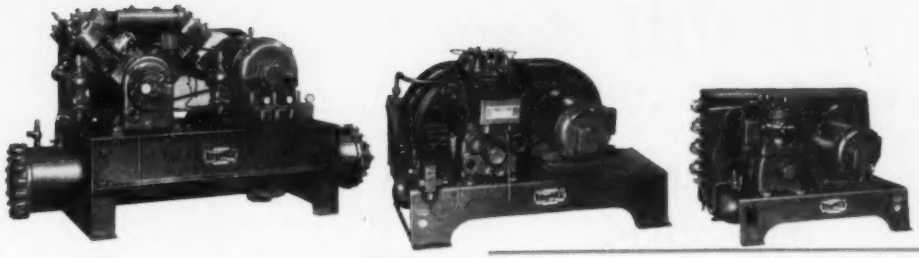
Crane No. 3692XS Cast Steel Vertical Ball Lift Check. Compact and sturdy, with heavy metal sections. Has leakproof male and female joint with corrugated soft iron gasket. Ball disc is solid hard Exelloy, highly polished, with guided seating to integral seat ring. Sizes up to 2 inches. Consult your Crane Catalog or Crane Representative for full details.

The Complete Crane Line Meets All Valve Needs. That's Why
More Crane Valves Are Used Than Any Other Make!

CRANE VALVES

CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



FOR REFRIGERATION UNITS FOR ANY NEED

HIGH, MEDIUM, LOW OR SUB ZERO

TEMPERATURES

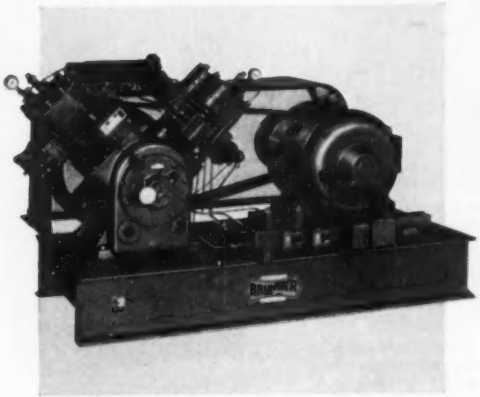
YOU CAN'T BEAT

BRUNNER
SINCE 1906

CONDENSING UNITS OR

COMPRESSOR UNITS

FOR USE WITH EVAPORATIVE CONDENSERS



DEPEND UPON BRUNNER TO GIVE YOU

A complete line of refrigeration units—69 models from ¼ HP to 75 HP.

One-year warranty against defects in material and workmanship.

Exclusive design features that assure maximum life and trouble-free performance.

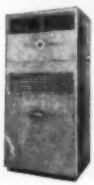
Full cooperation and advice of Brunner engineers in planning unusual installations.

A profit-builder for you—backed by Brunner's national advertising to your customers and prospects.

For dependable refrigeration . . . easy to install, operate and service . . . you can depend upon Brunner. Year after year, Brunner "open type" refrigeration units continue to set new standards of quality, reliability and operating efficiency. Your customer *stays* satisfied—because Brunner *stays* on the job. Annoying, costly service calls are held to a minimum. And . . . when service *is* necessary . . . you save time and save money for your customers because Brunner units are so accessible and easy to service.

Install these performance-proved Brunner refrigeration units—in sizes from ¼ HP to 75 HP. You'll see why Brunner is *your* customers' best buy . . .

BRUNNER MANUFACTURING COMPANY, UTICA 1, N.Y., U. S. A.



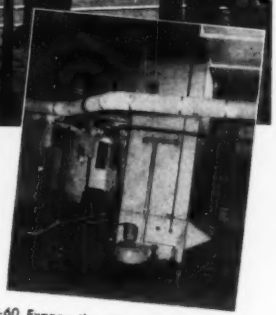
AIR CONDITIONING
Self Contained Units in 5 sizes:
2—3—5—7½ & 10 HP.

Send me without obligation . . . your informative Brunner Refrigeration Condensing Units catalog. Write Dept. L-12.

See us at the
11th INTERNATIONAL
HEATING AND VENTILATING EXPOSITION
International Amphitheater—Chicago
January 26-30
BRUNNER BOOTHS 2-209, 213, 215

VERSATILE *Acme*
EVAPORATIVE CONDENSERS
fit wide range of applications

The First Church of Christ Scientist in Birmingham, Alabama.



FP-60 Evaporative Condenser installation at the First Church of Christ Scientist.

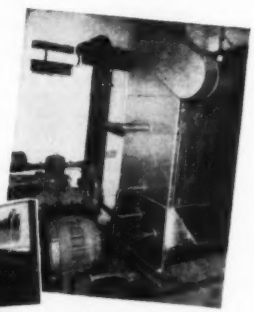
Two recent installations of Acme Evaporative Condensers show the wide range of applications for which they are ideally suited. The ability to conserve water makes the operation very economical, while the functional design assures complete hot weather comfort.

One installation was made in the First Church of Christ Scientist in Birmingham, Alabama, by the Hardy Corporation. The main auditorium seated 650 persons and a Sunday School room accommodated 148 more. Despite the variable load and Birmingham's hot climate the FP-60 Acme Evaporative Condenser has been highly efficient and completely satisfactory.

A completely different installation was made by the Krauss Heating and Ventilating Company, at the Gulf Winds Restaurant in St. Petersburg, Florida. An FP-30 evaporative condenser serving as an important component of the air conditioning system, was installed.

The air conditioning added much to the comfort of the patrons of this beautiful restaurant. Despite the unusual hardness of the water, the equipment is satisfactory in every respect, saving over 95% of the water used.

Write for more complete details on the advantages of Acme Evaporative Condensers



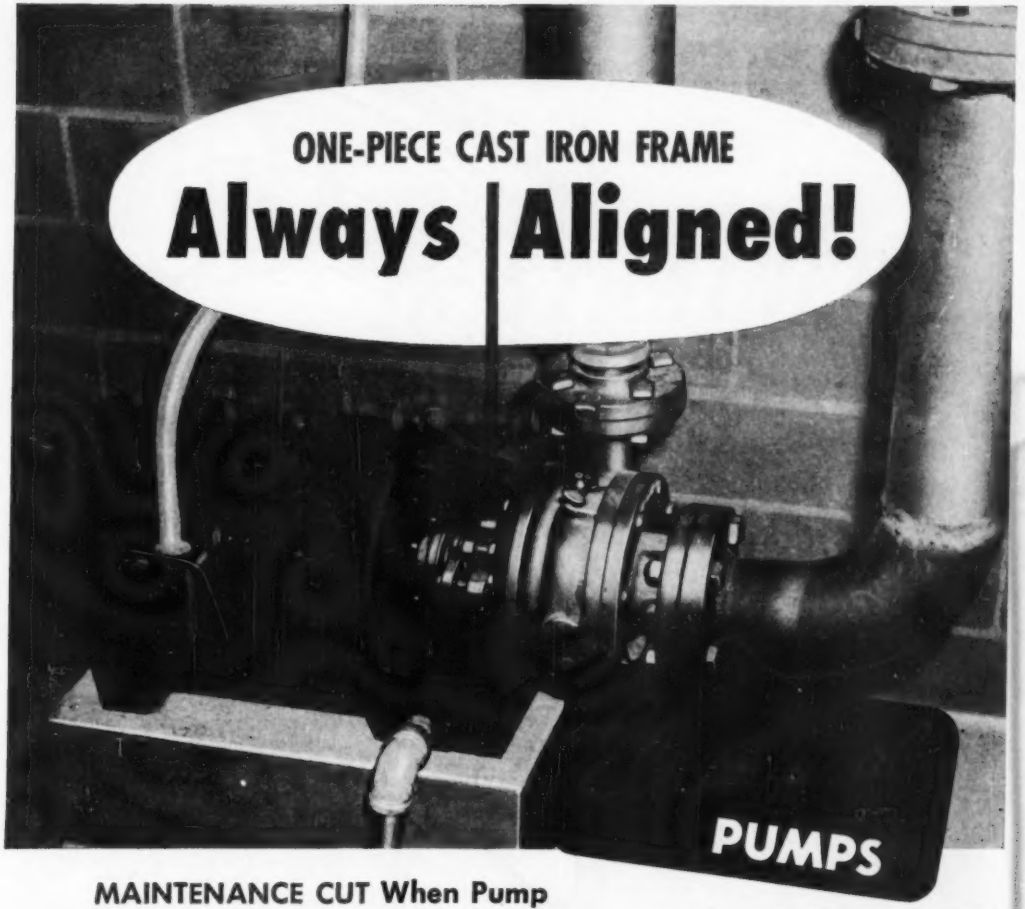
FP-30 Evaporative Condenser installed at the Gulf Winds Restaurant.

The Gulf Winds, popular St. Petersburg, Florida restaurant.

ACME INDUSTRIES, INC. JACKSON, MICHIGAN, U. S. A.

Air Conditioning and Refrigeration Division

CONTINUOUSLY SERVING THE AIR CONDITIONING AND REFRIGERATION INDUSTRIES SINCE 1919



MAINTENANCE CUT When Pump and Motor Use Same Frame and Shaft

ELIMINATE TROUBLES caused by misalignment . . . excessive wear of bearings, packing, and couplings. For lower maintenance, standardize on Allis-Chalmers package pumps . . . the pump with permanent alignment built in.

The complete pumping unit comes to you in one piece. Simply bolt it to the floor, connect power and piping, and you're ready to pump. No special foundation, no couplings or extra parts required.

Both motor and pump are designed together . . . built together by Allis-Chalmers. And there's a nation-wide chain of Certified Service Shops to back up your installations. Built in sizes from 10 to 500 gpm; heads to 220 ft.

Call your nearby Allis-Chalmers distributor or district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3872

Electrifugal is an Allis-Chalmers trademark.

ALLIS-CHALMERS

NEW PUMP FILMS

See new series of 3 sound-slide films, widely praised by educational and industrial groups. Get practical, instructive information on theory, application, installation and maintenance of centrifugal pumps. Series is designed for showing to maintenance meetings, plant groups, and engineering societies. Arrange now for a showing! Call your nearby Allis-Chalmers authorized distributor or district office. Or write Allis-Chalmers, Milwaukee 1, Wis.

exclusively spiral-wound construction

Forty years ago, when Henry Bohmer originated Flexitallic Spiral-wound Construction in gaskets, flange standards were 250 lbs., 400° saturated steam. Today flange standards are 2500 lbs. and 1050° superheat. The Flexitallic Gasket has played an important role in this development. As pressures and temperatures rose Flexitallic engineers found the combination of metal "spring" and non-metal filler that would hold the seal. Now, in the Process Industries, with pressures and temperatures rising to heights undreamed of even a few years ago—pressures to 4000 lbs., temperatures to 2000° F.—and with new acids and new gases coming into being almost every day, Flexitallic engineers are thinking ahead with the leaders in Industry in the adaptation of the Flexitallic Spiral-wound Construction to problems of the future. Write us your requirements . . . Flexitallic Gasket Company, Eighth and Bailey Streets, Camden 2, New Jersey. Representatives in principal cities. Consult your Classified Telephone Directory.

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Not all spiral-wound gaskets are Flexitallic. Look for the name FLEXITALLIC stamped into the metal spiral of every genuine Flexitallic Gasket. Look for *Flexitallic Blue* in gaskets with asbestos filler.

Get more of the FULL RATED PRESSURE with

ZURN engineered

Our 50th Anniversary

LOW PRESSURE DROP STRAINERS

THEY PERMIT HIGH RATES OF FLOW WITH REMARKABLY LOW PRESSURE DROP (LPD) AND IMMEASURABLY IMPROVE THE HANDLING OF FLUIDS (OIL, CHEMICALS, WATER) THROUGH PIPE LINES

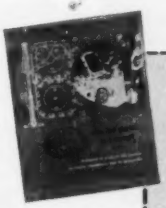
WHATEVER IS DONE to compensate for a loss of pressure usually results in an increased cost of handling liquids in pipe lines. But, compensation for the loss of pressure is usually unnecessary when Zurn Engineered Strainers are installed. Instead, a *reduction of pressure loss* is usually obtained. Zurn Low Pressure Drop (LPD) Strainers are design improved for correct circularity; have smooth inner walls combined with correctly sized and perforated baskets which reduce pressure loss and afford maximum protection for all types of mechanical units connected with pipe lines.

Zurn Strainers, are held to close manufacturing tolerances for materials, shape, and dimensions assuring the utmost in strength and safety. Zurn Strainer applications include fluid handling lines for lubricating and fuel oil, and oil during the refining process; a wide range of chemicals produced and used by the various process industries; public utility power plants; power stations; industrial plants; municipal water systems; ships and high temperature, high pressure installations. Zurn Fluid Handling Engineers are available for consultation on your fluid handling problems.

Zurn Duplex Multi-Basket Strainer.
Zurn Sinlox Strainer. Available in offset and straight-through types.
Zurn "Y" Type Strainers available in any cast material and for high pressures.
Zurn Duplex Plug Valve Strainer.
Pat. & Pat. Pending

There is a Zurn Low Pressure Drop Strainer for Every Fluid Handling Purpose.

Write for Pipe Line Strainer Manual No. 951, including previously unpublished pressure drop data.



J. A. ZURN MFG. CO.
INDUSTRIAL DIVISION • ERIE, PA., U. S. A.
In Canada: Canadian Zurn Engineering Ltd., Montreal, P. Q.

Copyright 1952

J. A. ZURN MFG. CO.
Industrial Division; Erie, Pa., U. S. A.
Please send me Pipe Line Strainer Manual No. 951

Name_____

Position_____

Company_____

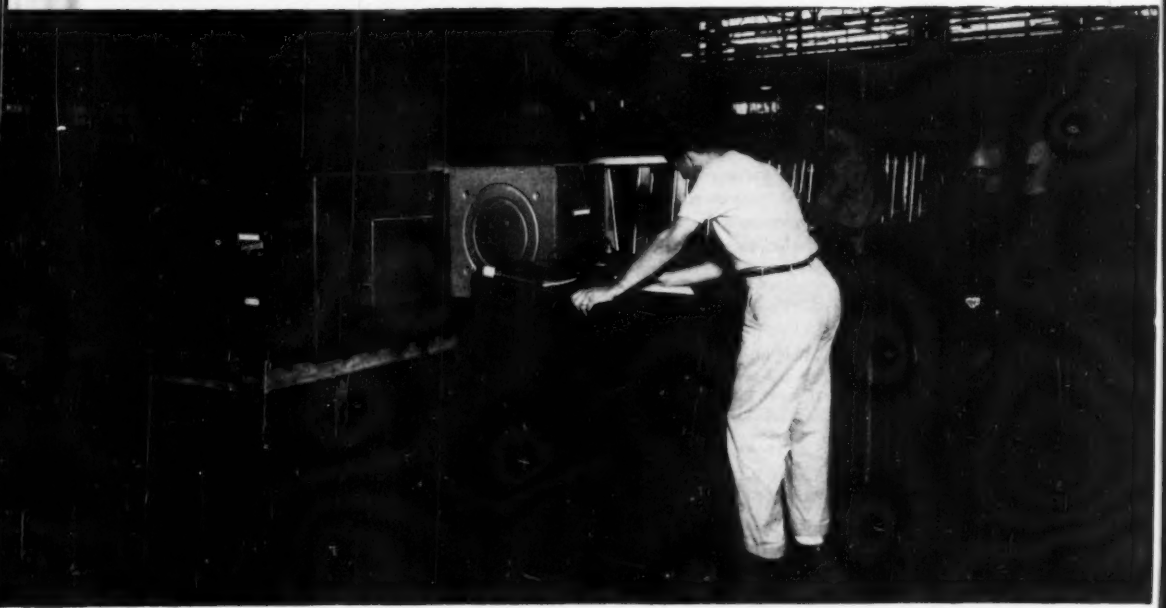
Street_____

City_____ State_____

Please attach to your business letterhead—Dept. HPAC

15,000,000 VOLTS flash 50 feet between giant lightning generators in General Electric's High-voltage Engineering Laboratory. Tests and research performed here make many improvements in various types of high-voltage equipment.

MAN-MADE LIGHTNING



TESTING AND ASSEMBLY of Electro-Klean units equipped with G-E Power Packs takes place in American Air Filter's Louisville plant.

MR. WILLIAM REED, president of the American Air Filter Company says, "We feel that the G-E power pack we use is one of the major advances in this field."

AAF'S ELECTRO-KLEAN UNIT, shown above, relies upon General Electric power pack to supply high-voltage direct current needed for electrostatic precipitation process. Power pack can be seen mounted at left of larger unit.

HELPS CLEAR THE AIR

High-voltage research aids in development of power pack for home air-filter equipment

Today at General Electric's High-voltage Engineering Laboratory in Pittsfield, Mass., 15-million-volt lightning strokes—most powerful ever created by man—are discharged at will under controlled conditions. Here, basic research on high voltage contributes to the improved design of many types of electrical apparatus.

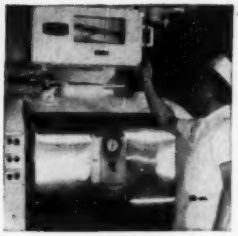
High-voltage power packs, for example, have now been developed by G. E. for a new type of electrostatic air cleaning equipment for the home—a brand new development in connection with home heating. Through electrostatic precipitation, dust particles as small as .25 micron (1 micron = 1/25,000 inch) can be collected! This process, used industrially for more than 40 years, is recognized today as the most efficient method for the control of fine particles of dust, smoke, soot, pollens or fumes in the home.

Working with G-E engineers, American Air Filter has succeeded in adapting this process to the home-heating field. The new AAF "Electro-Klean" unit, equipped with a G-E high-voltage power pack, is another indication of General Electric leadership in heating components. A leadership born of more than 25 years experience in supplying high-voltage equipment to the heating field. General Electric Co., Schenectady 5, N. Y. 411-103

IGNITION TRANSFORMERS

Another G-E product which contributes to the reliability of modern heating equipment. Exclusive 2-way self-shielding adds assurance against radio and tv interference.

GENERAL ELECTRIC



How Honeywell Customized Temperature Control helps people work better at American Institute of Baking Headquarters

Specially designed system meets wide variety of temperature control problems

One of the reasons the bakery goods you eat today are better bakery goods is because there's an organization called the American Institute of Baking.

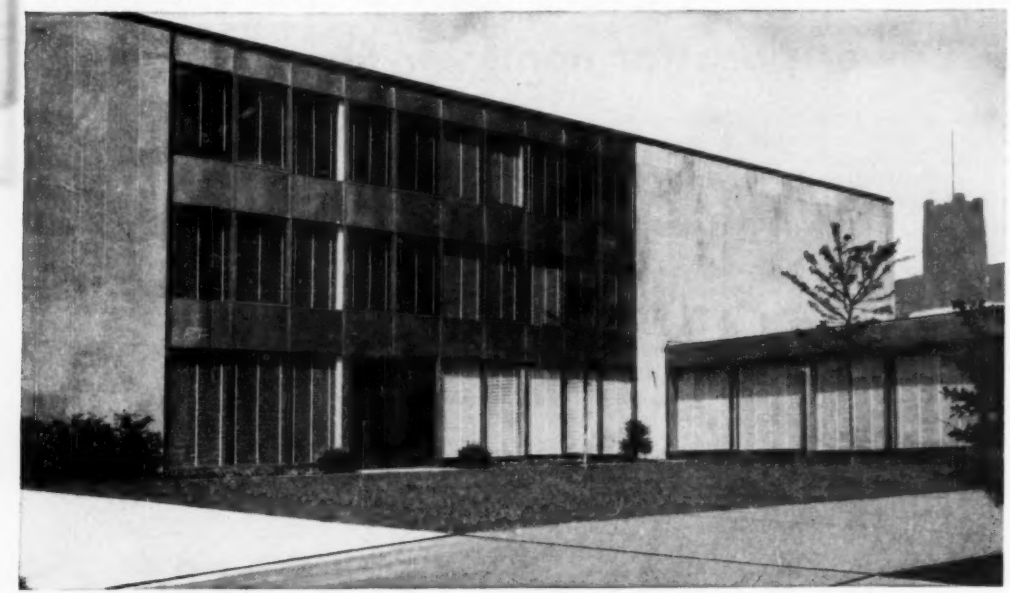
In its headquarters the Institute teaches better baking methods and conducts research dedicated to producing superior bakery products.

Specially designed to meet the variety of temperature needs of this modern three-story building is a Honeywell Customized Temperature Control installation.

This installation—with fourteen different temperature zones regulating heating and cooling—compensates for occupancy, use and exposure factors in the institute's kitchens, bakeries, classrooms, offices and laboratories.

And, according to Institute executives, the ideal "indoor climate" Honeywell Customized Temperature Control provides has helped appreciably in creating the organization's well-known atmosphere of efficiency.

Chicago headquarters building of American Institute of Baking was designed by Skidmore, Owings & Merrill



For Comfortable, Even Temperature in New or Existing Buildings – of any size – specify Honeywell Customized Temperature Control

Whether it's an office, factory, hospital, apartment, store, school, garage – or any size building – new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate" – and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design.

Then, too, when it comes to performance, Honeywell-built controls assure years of trouble-free operation. And they're backed by the finest service organization in the controls industry.

For full facts, call any one of the 96 local Honeywell offices. Or mail the coupon today.

Kasmir "Casey" Lemeka, American Institute of Baking's chief engineer, says: "First of all, I like our Honeywell Customized Temperature Control installation because it keeps people happy by furnishing constant comfort – everywhere in the building. But from my standpoint, another feature that's mighty important is the need for very little maintenance. In short, the system works right – and doesn't need to be babied."

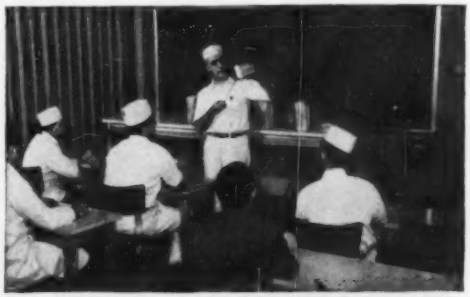
MINNEAPOLIS **Honeywell**

First in Controls

H HONEYWELL

Honeywell Customized Temperature Control helps promote worker efficiency by preventing offices from becoming uncomfortably hot – or too cold. In the above office – located in heating zone 1 – the system often must compensate for strong lake winds.

The test kitchen is located on the second floor in temperature zone 9. The thermostat in this temperature zone easily compensates for extra heat from the ovens and from solar radiation on sunny days, thus providing ideal comfort and raising worker efficiency the year 'round.



Zoned temperature control is extremely important in the large lecture room on the ground floor – located in temperature zone 2. Besides compensating for many large windows facing south, the thermostat keeps the temperature just right – for large or small classes.

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HA-12-246, Minneapolis 8, Minnesota

Gentlemen: I'm interested in learning more about Honeywell Customized Temperature Control.

*Name*_____

*Firm Name*_____

*Address*_____

*City*_____ *Zone*____ *State*_____

The fittings that revolutionized pipe welding . . .

In the year 1931 Taylor Forge gave industry its *first real line* of seamless, butt-welding pipe fittings. We say it was the first *real* line because it was the first to include not only long and short radius ells, but also full branch and reducing tees, concentric and eccentric reducers, stub ends, caps and welding neck flanges.

This was a fully planned development. Many years before Taylor Forge had foreseen the future of the butt-welding fitting . . . had realized that pipe welding could not go beyond its then crude stage until pipe users were given *all* the fittings necessary to make up complete piping systems.

So Taylor Forge went to work on this and after long research and development came out with the full line that became the inspiration of modern pipe welding.

Naturally the organization that started ahead has kept ahead . . . in design, in quality, in breadth of line. That is why so many men who have followed the development of the WeldELL line, refuse to consider any other kind of welding fittings.

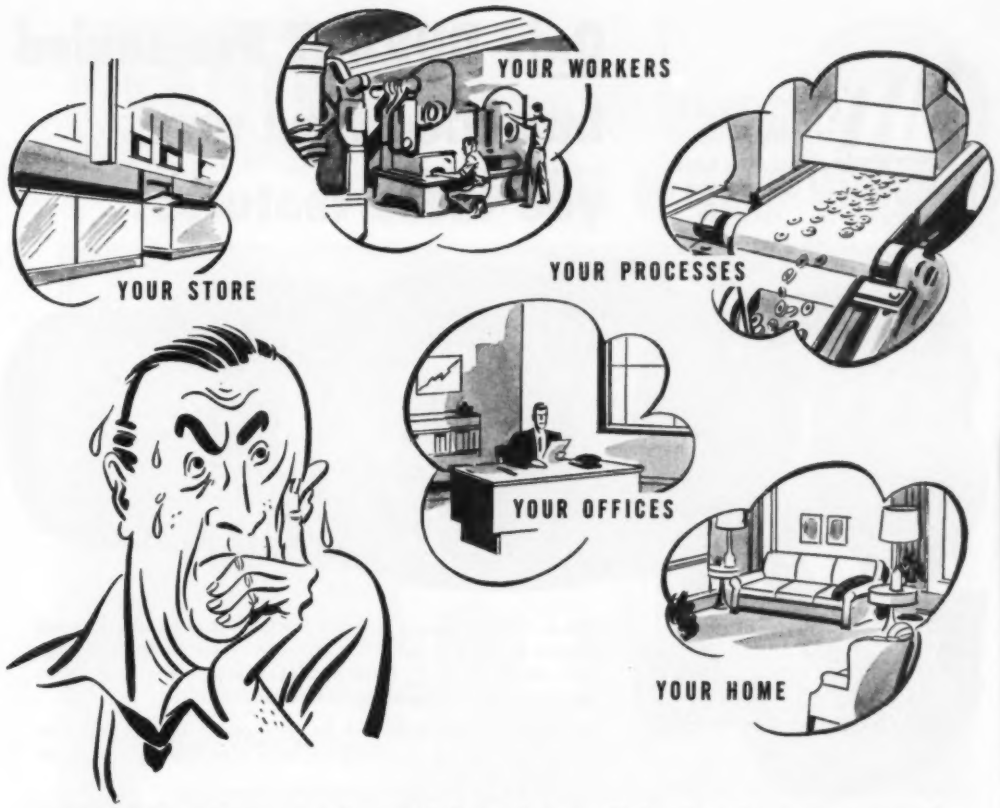
T F

For up-to-the-minute facts, see your Taylor Forge distributor

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS, General Offices and Works: P.O. Box 485, Chicago 90, Ill. 716-0852

Offices in all principal cities. Plants at: Carnegie, Pa.; Fontana, Calif.; Hamilton, Ont., Canada



Remember how you longed for air conditioning last summer?

You swore you'd never go through another summer without air conditioning. Now—today—is the time to do something about next summer. Here's why:

Your Westinghouse Contractor isn't rushed now. His men can install your new unit faster, better . . . without overtime. He will save you money. And he will do the work when it suits *you*—without disrupting your business.

It will pay to select Westinghouse equipment because:

Westinghouse costs less to operate. Its refrigerant-cooled motor saves on electric power and upkeep. Its hermetically-sealed design means less maintenance, fewer service calls.

Westinghouse gives better performance. Only Westinghouse designs and builds all components. This means smoother operation and longer life, because all parts have been precision-built to work together.

Westinghouse has a full equipment line. Whatever you require, from 2 tons up, a Westinghouse system will match your needs. Only Westinghouse offers so complete an air conditioning line.

Interested? Want to do some advance planning? Then send for the Westinghouse Planning Guides. Or better still, call your local Westinghouse Air Conditioning Contractor for a free estimate. He'll be glad to help you. He's listed in the Yellow Pages of your classified directory.

YOU CAN BE SURE...IF IT'S

Westinghouse

AIR CONDITIONING

Westinghouse Electric Corporation
Air Conditioning Division
179 Damon Street
Hyde Park, Boston 36, Mass.

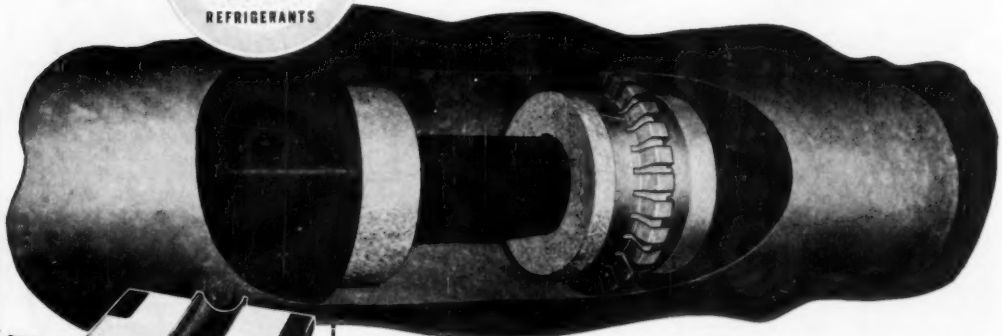
- ☐ Send me the "Planning Guide for Commercial Air Conditioning".
- ☐ Send me the "Planning Guide for Industrial Air Conditioning".
- ☐ I want a free estimate of the cost of air conditioning my premises.

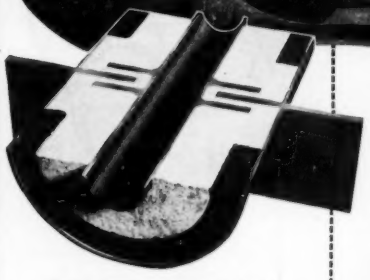
Name.....
Company.....
Address.....
City.....Zone.....State.....

D.I.P.®

FIRST IN THE FIELD OF PRE-SEALED INSULATED PIPING FOR STEAM HOT WATER REFRIGERANTS

Only DURANT Pre-sealed Insulated Pipe gives you these features:





Durant Patented Insulated Anchor

Inspection of D. I. P. after 15 years' service revealed no sign of corrosion, no loss of insulation efficiency, no breaks in asphalt. Note backfill of refuse building materials. Installation is on former city dump.

• D. I. P. is the only pre-sealed insulated conduit that does not depend on a metal jacket for protection from moisture, leakage and corrosion. A 1″ layer of high-melting-point, non-porous asphalt is the waterproofing protection.

This means: deterioration of the metal casing underground is of no concern. Years of service and even complete submersion do not harm D. I. P.

• By design, Durant's Patented Supporting Ring allows asphalt to flow through openings during fabrication to *encase* the ring.

This means: water or moisture cannot pass through support points to the insulation or pipe. It means efficient insulating properties and extreme durability.

• Durant's Patented Insulated Anchor eliminates contact between anchor plate and pipe.

This means: reduced heat loss and elimination of corrosive electrolytic action at anchor points.

Many other advantages come with D. I. P.—such as low cost installation, for the Durant field joint can be made swiftly and easily. D. I. P. does not require external casing-welding: nor does it require concrete tunnels, slabs, rollers, supports, drains or additional protection for superimposed loads—such as under roadways or railroad tracks. Steam pressures to 1000 psi.

Durant's engineering staff and representatives are at your service. Write us today for Catalog A-12.

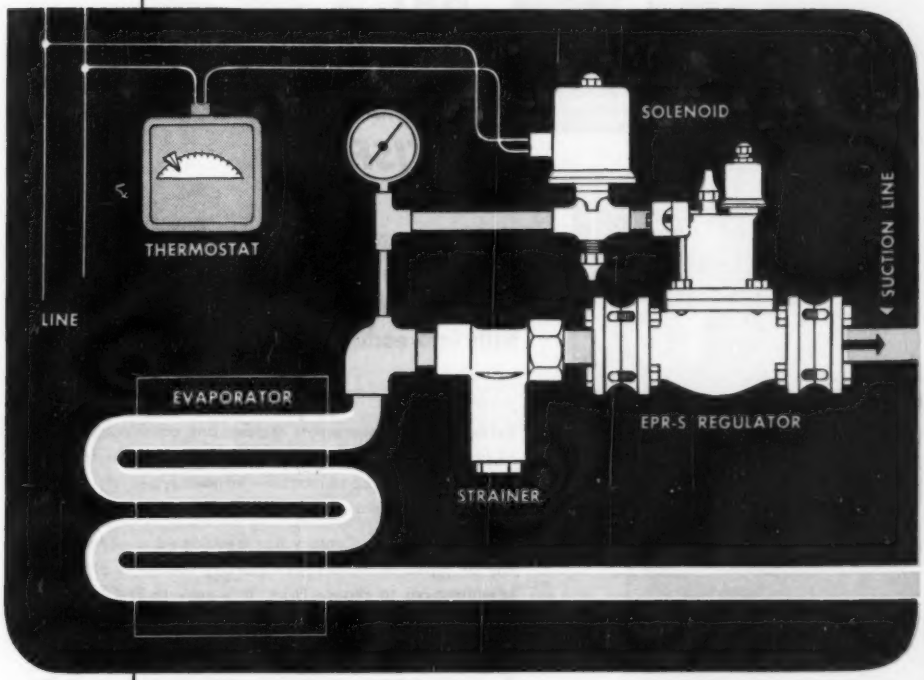
Representatives in Principal Cities

PRE SEALED®

Western Division: **DURANT INSULATED PIPE COMPANY**
WARREN WAY AND BAY ROAD, PALO ALTO, CALIFORNIA

Eastern Division: **DURANT INTERNATIONAL CORPORATION**
WILLIAMSTOWN, NEW JERSEY

ALCO SOLENOID-EPR COMBINATION for TEMPERATURE DIFFERENTIAL CONTROL



Try this performance-tested ALCO team—the EPR for accurate evaporator pressure regulation, *plus* the Solenoid for positive suction stop. Together, they solve the toughest close-control problems.

This ALCO Solenoid-EPR Combination is widely used on installations where pinpoint control is important: in the handling of plasma, biologicals, plastics and synthetics, and for food preservation on commercial and combatant ocean vessels throughout the world.

Try it on your next job where close control counts.

For further details, write for Bulletin 183.

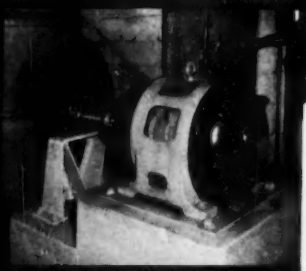
Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

SEE YOUR ALCO WHOLESALER

ALCO VALVE CO.

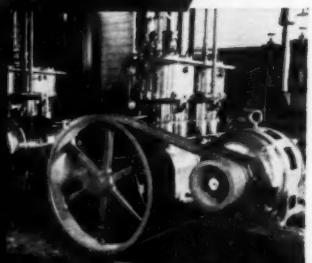
861 KINGSLAND AVE. • ST. LOUIS 5, MO.

4585



100 horsepower Century motor on a glass blowing machine.

WHY Century MOTORIZED EQUIPMENT KEEPS YOUR CUSTOMERS *SATISFIED...*

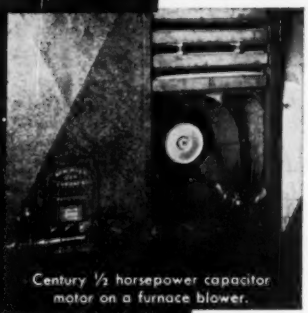


Two 100 horsepower Century motors driving refrigeration compressors.

The motor specifications—where skillfully selected—to assure the TOP PERFORMANCE and DEPENDABLE QUIET SERVICE that is built into each class of equipment.

Refrigeration compressors require one combination of operating characteristics and specifications—fans and blowers another combination—various types of heating equipment still another.

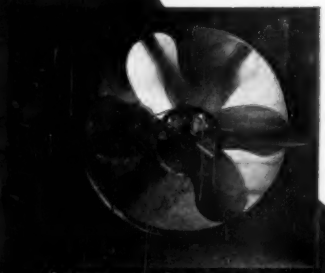
In over 50 years, Century has developed a wide line of types of motors with literally hundreds of specifications to choose from. It is easy to ENGINEER YOUR PRODUCT PERFORMANCE—THROUGH SKILLFUL MOTOR APPLICATION.



Century ½ horsepower capacitor motor on a furnace blower.

If you have motor service problems, phone or write to any of Century's 28 District offices regarding Century's national network of service stations—the motor exchange plan will serve you whether your motors are in or out of warranty.

Specify Century Motorized Equipment—get top equipment performance—dependable quiet service—keep your customers satisfied.

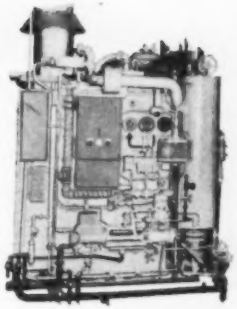


1/6 horsepower Century motor on a ventilating fan.

CENTURY ELECTRIC CO
1806 Pine Street • St. Lo

Century C MOTORS

The C-E Re-Circulation Steam Generator. Available in capacities up to 6,000 pounds of steam per hour, yet fits into a space less than seven feet square by eight feet high.



THE LAWRENCE PAPER COMPANY
LAWRENCE, KANSAS

OFFICE OF THE VICE PRESIDENT

September 29, 1952

Combustion Engineering Superheater, Inc.
1661 Board of Trade Building
Kansas City, Missouri

Attn: M. J. Clemens, Sales Engineer

Gentlemen:

Last February, we installed one of your C-E re-circulation steam generators in our plant.

This generator, rated at 6,000# of steam per hour at 200 Psi, serves our 74-inch corrugator. In spite of the wide fluctuations in amount of steam used due to the frequent starting and stopping of the machine, this generator has handled our steam load with ease.

One of the nicest features of the generator is the quickness with which it can be gotten into operation. In order to get started at 7:00 o'clock, we used to leave the steam on our corrugator all night but since the installation of this machine, one of the mechanics can start it in four or five minutes and have the machine heated up in less than half an hour.

The machine is so simple in operation that it is easy for one of the operators on the corrugator to look after it as well as tend to his duties on the corrugating machine.

We also find that we can vary the steam pressure for different types of orders and make a saving that was impossible to us with our old boiler set-up.

Although this equipment has only been in our plant eight months, we do not hesitate to recommend it as it has given us such fine service.

Yours very truly,

Justin D. Hill

Justin D. Hill,
Vice President

Mr. Hill says:
his C-E Re-circulation Steam Generator . . .

- Meets wide fluctuations in amount of steam used . . .
- Is adaptable to frequent starting and stopping . . .
- Handles steam load with ease . . .
- Can be started up in four or five minutes . . .
- Is simple in operation . . .
- Can be used for varying steam pressures . . .
- Makes a saving that was impossible with old boiler set-up . . .

. . . and Mr. Hill sums up these advantages by saying —

"We do not hesitate to recommend it as it has given us such fine service"

COMBUSTION ENGINEERING—SUPERHEATER, INC.

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

C-E

9-629

ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS AND AIR HEATERS

"Our Powermaster Boilers are dependable, efficient, easy to service, and economical to operate"

William H. Wagner
Plant Engineer
Blue Bird Silk Mfg. Co.

Alfred J. Sidler
Plant Manager
Blue Bird Silk Mfg. Co.

20% Saving in Steam Cost at York, Pa. Manufacturing Plant

William H. Wagner, Plant Engineer of the Blue Bird Silk Manufacturing Company, knows the problems of generating high-pressure steam 24 hours a day, 365 days a year. And he knows how serious it can be for a busy manufacturing plant if there is trouble or failure in the boiler room. That's why, two years ago, the company replaced their old-fashioned coal-fired boilers with two 200 h.p. POWERMASTER packaged automatic boilers, burning #6 (Bunker C) oil. Here is what they found:

- The cost of producing steam for processing and heating dropped 20%.
- The steam produced now is much dryer.
- The POWERMASTERS respond very rapidly to variations in load.
- Maintenance has been negligible.

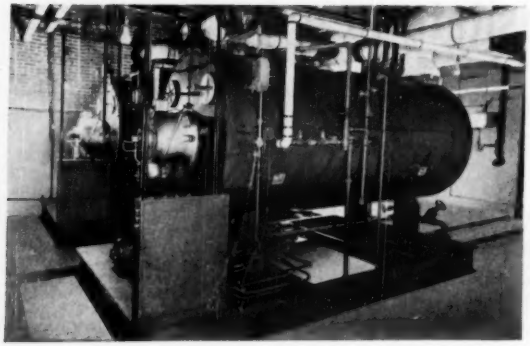
Little wonder that Alfred J. Sidler, Plant Manager, says, "If we had it to do over again, we would certainly buy POWERMASTERS."

No other packaged automatic boiler gives you *all 3 advantages of the Powermaster:*

1. SAVE FUEL—because the special *Powermaster* burner design gives you top efficiency when operating anywhere between 30% and 100% of capacity.
2. SAVE IN MAINTENANCE and clean-up time. Complete combustion of fuel gives practically smokeless and carbon-free operation. The burner has *no* moving parts to wear out . . . or to be cleaned daily.
3. CHANGE FROM OIL TO GAS (or gas to oil) in just a few minutes. Burn light oil, heavy oil, or gas—whichever is cheaper. You no longer need depend on one source of fuel supply.

Write for this Catalog

To get complete information about this modern packaged automatic boiler for steam or hot water, write for *Powermaster* Bulletin 1218. We'll be glad to put a copy in the mail for you.



These 200 h.p. POWERMASTER packaged automatic boilers have been operating round-the-clock for more than two years at the Blue Bird Silk Manufacturing Company, York, Pa. Burning #6 oil, they produce a total of 13,800 pounds of steam per hour.

Powermaster®

PACKAGED AUTOMATIC BOILERS

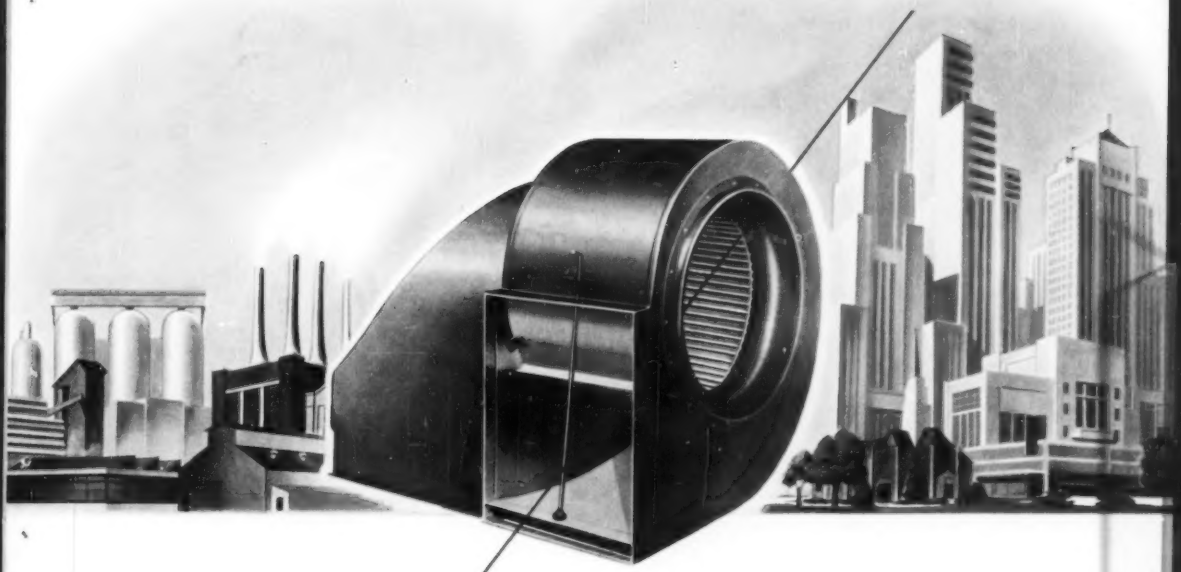
In sizes to 500 h.p.; pressures to 250 psi.

ORR & SEMBOWER, INC.

Established 1885

990 Morgantown Road, Reading, Pa.

American Blower – a time-honored name in air handling



The heart of an American Blower Utility Set is this dynamically balanced Sirocco wheel which provides large volumetric capacities at low peripheral speeds.

Need air in your business?

Want a "work horse" that has proved to be a good investment in hundreds of industries?

Then, put these time-proved, quality-built American Blower Utility Sets to work. They are unsurpassed for general ventilation where duct systems are required.

There's an American Blower product for every air handling need — for process work, for pressure duties, for ventilating, heating, cooling, air conditioning.

Just call one of our branch offices for data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary Corporation

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • ACME CABINETS • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Sailor Beware! The Old Man of The Sea!

WHO has not read of Sinbad, as told in the Arabian Nights by glamorous Scheherazade?

Shipwrecked on a strange island, the unfortunate sailor came upon a weak old man. Moved by compassion, Sinbad took the feeble fellow on his back, carried him over the brook, gathered fruit and fed him. But when Sinbad asked him to get down, the old man refused, wrapping his legs about his neck, almost strangling him.

The sailor fainted and fell down, yet the old man clung ever closer. He rained blows on Sinbad, driving him about without rest, to pick fruit and do his pleasure. This went on and on, until the desperate sailor made wine from wild grapes to appease his own plight. One day noting Sinbad's pleasure, the old man snatched a gourd of wine and gulped it down. Completely drunk, he loosened his grip and Sinbad threw him off. Saved by a passing ship, his rescuers said, "You are the first ever to escape strangling by the Old Man of the Sea".

Dating back hundreds of years, the Old Man is an allusion familiar to everyone. He is a warning figure today. Our nation, surviving the storms of two world wars, wanders down strange ways. With kindly intent and glorying in its own strength, America is tempted to shoulder the Old World and its age-worn problems. But weak and feeble as the Old World appears to be, let us beware! How easy to assume a burden which would quickly exhaust our strength, strangle us as a nation, and in the end leave the world as weak and exhausted as it was before our foolish undertaking!

QUALITY YOUNGSTOWN SERVICE

The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

Associated Architects: Mayer & Whittlesey • Skidmore, Owings and Merrill
Consulting Engineers: Jaros, Baum & Bolles
Heating Contractor: J. L. Murphy, Inc.

Owned and Managed by NEW YORK LIFE INSURANCE COMPANY

Manhattan House

—with 882 modern, carefully planned apartments occupies an entire block at 66th and 2nd Ave., New York City. Comfort and fuel savings obtained here, year after year, will yield a handsome return on its investment in POWERS control.

Type D Room Thermostat

(a77)

POWERS®

ZONE TEMPERATURE CONTROL

In this Outstanding Apartment Building Assures Comfort, Dependability, Lowest Maintenance Cost

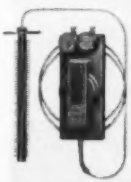
Temperature of hot water supply to convectors in this modern building is controlled by a Powers **MASTROL** System.

How It Operates—A Powers Master Thermostat with its sensitive bulb in a special housing for sun-wind effect and outdoor temperature is located on outside wall of zone being controlled. It operates in conjunction with 4 Room Thermostats on the 4th, 9th, 14th and 19th floors of each zone through Averaging Relays to establish the control point for Series 100 Sub-Master Controllers. A manually operated switch on the main control panel is provided to raise or lower the control point when desired.

A program clock automatically reverts the controls to night operation during which period the outdoor Master Thermostat readjusts Series 100 Sub-Master Controller to a lower control point than used during day operation. Other types of Powers controls regulate various fans supplying heating and ventilating to other spaces in the building.

Experience gained by Powers in all types of prominent buildings will be helpful to you. When problems of temperature and humidity arise, contact our nearest office.
THE POWERS REGULATOR COMPANY, Skokie, Ill.

OVER SIXTY YEARS **OF AUTOMATIC TEMPERATURE AND HUMIDITY CONTROL** POWERS CONTROL **OFFICES IN OVER 50 CITIES**



Outdoor Master Thermostat

Averaging Relay

Indoor Sub-Master Controller

METAFLOW Control Valve

ACCRITEM Regulator

POWERSTROKE

Damper Motor

AIRSTREAM Thermostat

Pneumatic Switches

FLOWRITE Control Valve

FOOD FAIR *Selects*

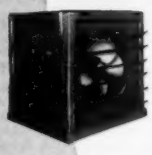
Marlo

AIR CONDITIONING and REFRIGERATION

New Food Fair Warehouse and Office in Washington, D. C. Architect: Leon Chatelain; Air Conditioning Contractor Washington Refrigeration Co.

. . . to protect meat and produce!

. . . to keep office workers comfortable!



For food refrigeration that keeps meats and produce fresh (and profitable) . . . Marlo gravity-type cooling coils and DUC pull-through unit coolers were used.

From meat and produce coolers to the spacious offices, this modern new Food Fair Warehouse and Office building depends on Marlo quality for its air conditioning and refrigeration needs.

A quiet Marlo Cooling Tower (installed out-of-sight) serves all air conditioning and refrigeration needs . . . with *maximum* water savings.

For perfect year 'round comfort . . . Marlo ceiling type air conditioning units were installed (with complete control over summer-winter comfort needs).

Solve your refrigeration and air conditioning problems—best—with Marlo equipment.

Marlo

COIL COMPANY

Manufacturers of COOLING TOWERS • EVAPORATIVE CONDENSERS • INDUSTRIAL COOLERS • AIR CONDITIONING UNITS • MULTI-ZONE UNITS • BLAST HEATING & COOLING COILS

Saint Louis 10, Missouri

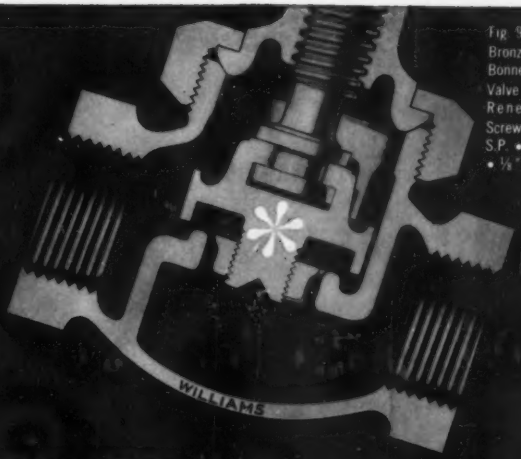


Fig. 912–913
Bronze Vulcodisc Union Bonnet Globe and Angle Valve • Integral or Renewable Seat • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ⅛" to 3".

REDUCE COSTLY "SHUTDOWN" TIME . . .

Specify D.T. Williams "Vulcodisc" Valves

RUGGED CONSTRUCTION! Valve is quality engineered from high grade steam bronze for greatest wall strength —longest service life!

RENEWABLE DISCS! Can be quickly replaced without removing valve from line—prevent service delays!

SPECIAL "VULCO" DISC COMPOSITION! Allows foreign matter to impregnate disc harmlessly—prevents shutdowns due to disc chipping or cutting.

3 DIFFERENT DISCS AVAILABLE! Three special composition discs are available for use in Vulcodisc Valves. Fig. 825 for steam, Fig. 826, air and water; Fig. 827, oil or solvents. For additional information either see your nearest jobber or write for literature.

Fig. 1176
Bronze Vulcodisc Quick Operating Union Bonnet Globe Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ¼" to 2".

Fig. 840
Bronze Vulcodisc Quick Operating Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ⅛" to 2".

Fig. 856
Bronze Vulcodisc Horizontal Check Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ⅛" to 3".

Fig. 1086
Bronze Vulcodisc Swing Check Valve • Screwed Ends • 200 lbs. S.P. • 400 lbs. W.O.G. • ¼" to 3".

GUARDIANS OF THE PIPELINES
D.T. Williams VALVES

THE D. T. WILLIAMS VALVE CO.
FOUNDED 1900
DIVISION OF The Schaible Company
1086 SUMMER STREET • CINCINNATI 4, OHIO

Want a look at the overalls picture?

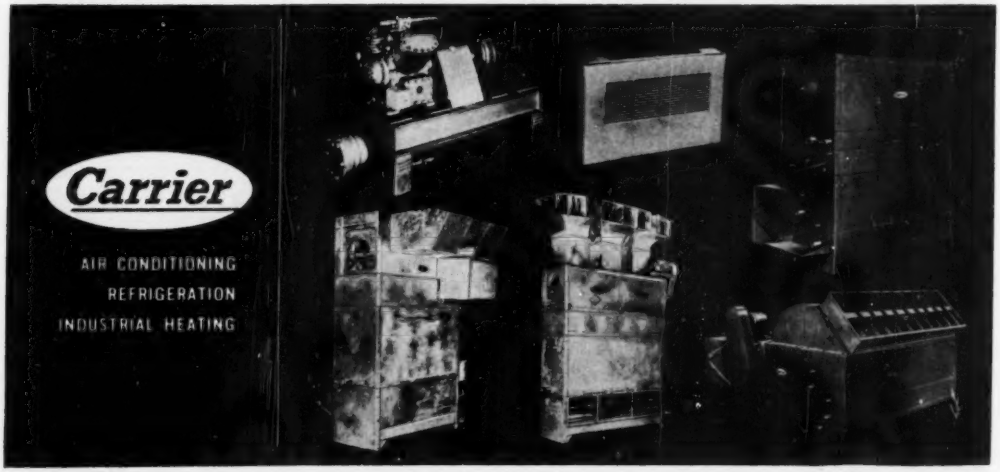
When we build the equipment you sell, we figure the Overalls Factor to be mighty important.

That's why there are always overalls in the Carrier picture. In all departments from drafting room to production line, there are men who have that certain "know-how" they got by working with equipment in a variety of applications.

It's only with their experience behind us that we can design and manufacture equipment that's going to do the job for your customers . . . that can be easily installed and serviced by you.

That's what makes the Carrier line so exceptional. It's a family of products built with you in mind . . . a family of products matched in size, performance and quality to put the most flexible air conditioning tools in your hands.

For instance . . . for small or medium size buildings there's a choice of systems to meet your needs. There's the Carrier low-pressure Weathermaster duct system with its volume control for individual rooms. And, for air conditioning the larger open spaces of multi-room buildings, such as meeting and assembly rooms, stores, restaurants and the like, there's the Carrier System and Zoning Weathermakers—each sectionalized to be fitted into your requirements for both comfort and industrial air conditioning. Carrier Corporation, Syracuse 1, New York.



REFRIGERATING COMPRESSORS DUCT WEATHERMASTER SYSTEM WEATHERMAKERS
EVAPORATIVE CONDENSERS COLD DIFFUSERS ZONING WEATHERMAKERS

HERE'S A

Winning Combination

*REG. U. S. PAT. OFF.
†A PATENTED PROCESS RE 22469

FOR YOU This one-ton heat exchanger consists of Wolverine copper Trufin* (nine-fins-to-the-inch)—the integral finned tube—coiled up in an extremely small radius forming a compact mass inside a copper shell. The ends of the shell are reduced by the special Wolverine Spun End Process† to a small diameter to receive tube connection.

This is one of many combinations of Trufin and Spun End Process that can be fabricated to your specifications.

Trufin, you know, is the tube with the fins that are extruded from the tube wall. Trufin's unique *integral* construction will withstand vibration and extreme temperature changes.

The Wolverine Spun End Process is a method of forming ends of tube into special shapes, fast and economically.

We'll gladly send you our new brochure, Spun End Process, upon request on your stationery.

WOLVERINE TUBE DIVISION
CALUMET & HECLA, INC.
Manufacturers of tubing exclusively
1419 Central Ave. • Detroit 9, Mich.

Wolverine Trufin and the Wolverine Spun End Process available in Canada through the Unifin Tube Co., London, Ontario.

Sales Offices in Principal Cities

Wolverine Mill Depots:
DETROIT, MICH. • DECATUR, ALA. • HOUSTON, TEXAS • LOS ANGELES, CALIF.
LONG ISLAND CITY, N. Y. • PHILADELPHIA, PA. • PROVIDENCE, R. I. • ST. LOUIS, MO.

Export Department, 13 E. 40 St., New York 16, N. Y.

Vulcan Preferred...

IN THE "LONG RUN" IT COSTS LESS

FOR CONSULTING ENGINEERS

VULCAN RADIATION is *preferred* by practical consulting engineers because of VULCAN'S overall practical simplicity in design. Both RADI-VECTOR and LINOVECTOR easily fit into any plan . . . new construction . . . extension . . . modernization . . . or on major repair jobs. In the "long run" it pays to specify VULCAN.

FOR CONTRACTORS

VULCAN RADIATION is *preferred* by contractors because of ease in installation. VULCAN is light in weight . . . requires less piping . . . fewer fittings and supports . . . comes in convenient increments of 1' up to 12' with ends threaded or chamfered for welding. In the "long run" VULCAN saves time, manpower and money . . . on the job.

FOR MAINTENANCE ENGINEERS

VULCAN RADIATION is *preferred* by maintenance engineers because of trouble-free operation . . . quick response to heating controls . . . ease of keeping clean. Also for VULCAN'S positive safety factor . . . all steel units guaranteed for 450 psi. In the "long run" VULCAN maintenance costs less.

* Trade-mark Reg.

Made in Canada Under Trade Name of Heal Radiation by the Vapor Car Heating Co. of Montreal.

WRITE FOR ILLUSTRATED CATALOGS

Illustrated for drawing board reference. For complete I=B=R rating and step-by-step instructions for RADI-VECTOR (residential) baseboard installation request Bulletin 53A. For LINOVECTOR (commercial) ask for Bulletin No. 625.

Most Complete Line in the Industry

The Vulcan RADIATOR CO.

16 FRANCIS AVE., HARTFORD, CONN.

Over 27 years a leader in Fin-Tube Radiation

Representatives in Principal Cities

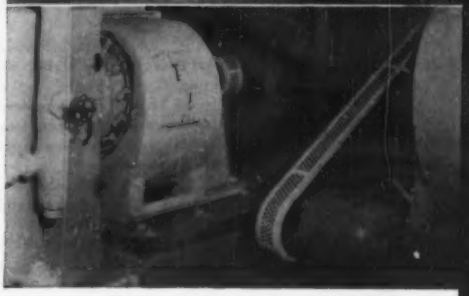
Dun & Bradstreet HAS HIGH COMFORT STANDARDS

-Uses "Buffalo" FANS

in unusual high-pressure small-duct ventilation systems

●

"Almost from the first, the equipment and systems worked exactly as they were intended to . . ." from OFFICIAL BULLETIN, Heating, Piping and Air Conditioning Contractors National Association. Below are shown "Buffalo" high pressure fans on the 12th floor. All photos, courtesy Kerby Saunders, Inc.



Above, Dun & Bradstreet Building, New York City, Reinhard, Hofmeister & Walquist, Archt. Syska & Hennessy, Inc. Consulting Engineers; George A. Fuller Co., General Contractors; and Kerby Saunders, Inc. Air Conditioning Contractors.

Occupants of this ultra-modern building enjoy man-made air comfort every day in the year, and behind this comfort are seven large high-pressure "Buffalo" Fans which propel conditioned air to all parts of the building. Yet, gone are the traditional large air ducts, and in their place, small pipes. These save valuable space, yet carry large volumes of air, because the "Buffalo" Fans are forcing it through faster and at higher pressure, QUIETLY! It's a relatively new concept of air delivery, and a hard job for ventilating fans, yet these "Buffalo" Limit-Load Fans are equal to it. Their non-overloading characteristic makes it impossible to burn out a drive motor, no matter how the system pressure varies.

What is *your* job for air? "Buffalo", with its complete line of proven air handling units and its 75 years of experience in air, is ready to help you get the best possible results, as it has helped Dun & Bradstreet and many other well-known firms.

DIAMOND JUBILEE 75TH ANNIVERSARY

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

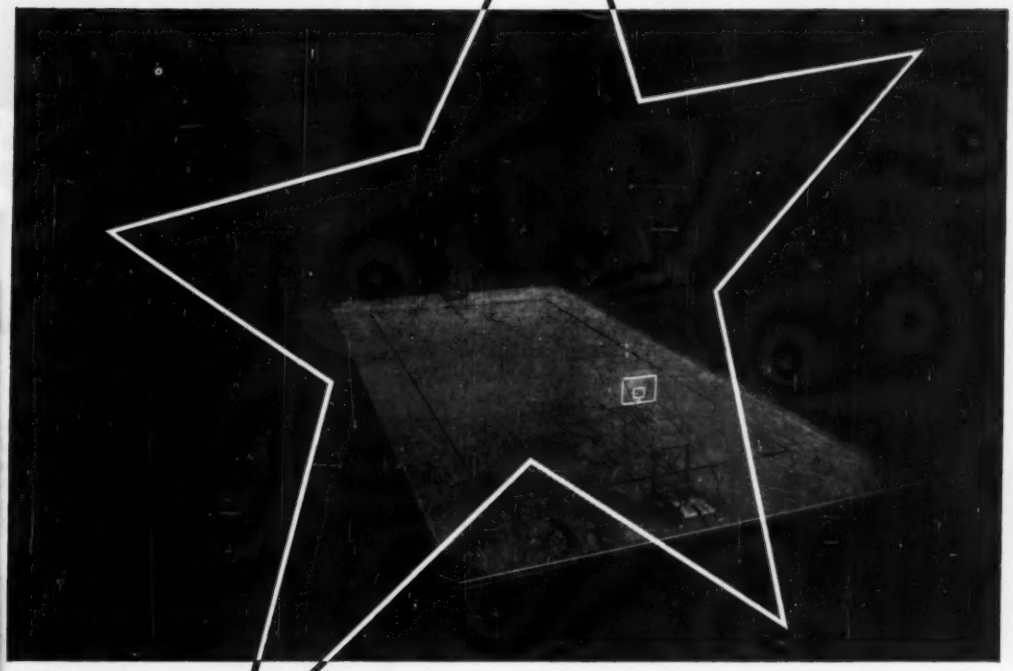
171 MORTIMER ST. - BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING | PRESSURE BLOWING | AIR CLEANING | COOLING | AIR TEMPERING | HEATING | INDUCED DRAFT | FORCED DRAFT | EXHAUSTING

SPANG® CW is a star performer



in the University of Detroit's new Memorial Building

Built to provide facilities for sports, plays, lectures and other important campus activities, the University of Detroit's new Memorial Building is the last word in modern, up-to-date planning.

With a seating capacity of 11,000, this completely air conditioned, two and one-half million dollar structure is a major investment. Therefore, it was built with only the best materials . . . carefully planned to give long-time service, free from maintenance problems.

For instance, wherever pipe was needed—for plumbing, heating and air conditioning—reliable Spang CW Steel Pipe was installed 100%.

And there was a good reason. Spang CW is *the quality-controlled* pipe. Constantly inspected through every step of manufacture and carefully controlled during forming, Spang CW always gives complete dependability and freedom from trouble.

Which explains why Spang Steel Pipe has just the right characteristics to give easy threading, bending and cutting . . . features that speed installation time and reduce costs.

So don't just ask for pipe. Specify *better* Spang CW Steel Pipe from your local Spang distributor.

Owner: University of Detroit
Architect: Harley, Ellington & Day, Inc., Detroit, Michigan
General Contractor: W. E. Wood Company, Detroit, Michigan
Piping Contractor: Harrigan & Reid Company, Detroit, Michigan

SPANG-CHALFANT

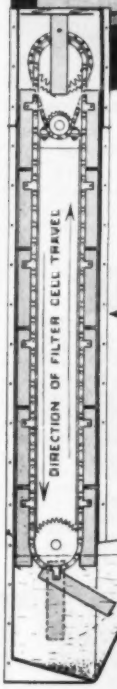
DIVISION OF THE NATIONAL SUPPLY COMPANY

General Sales Office: Pittsburgh 30, Pa. District Sales Offices: Atlanta, Boston, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis.

COMPARE

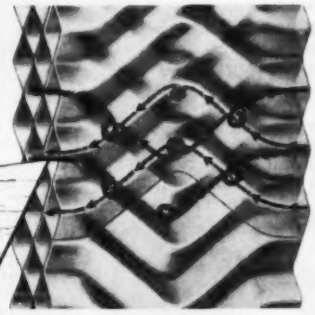
any other automatic, self-cleaning air filter, with CONTINENTAL!

You will then be convinced that Continental Automatic, Self-Cleaning Air Filters are unexcelled in engineering and construction. You will then fully appreciate Continental's three exclusive advantages! So . . compare . . and learn why Continental provides unequalled air-filtering performance.



CONTINENTAL automatic

- *non-clogging*
- *self-cleaning*
- *non-reversing*
- *space-saving*
- *any capacity*



Compare Air Flow

In Continental Air Filters, the filter cells move up and across top of filter. Cells are free to rotate around an axis like the cars on a ferris wheel (see cutaway drawing). As cells, holding their vertical position, pass from front to back curtain, *there is no reversal of air flow* through the filter media. Result: in Continentals, dirt is *never* blown back into the clean-air stream.

Compare Self-Cleaning Action

As each cell, in Continental Air Filters, moves down into the cleaning oil, it is stopped and held in a semi-horizontal position (see cutaway drawing) until the accumulated dust is *soaked loose*. The cell then drops quickly into a vertical position. This action causes a surge of oil to pass through the filter media, *counter-air flow*. Result: In Continentals, a thoroughly self-cleaned filter.

Compare Air Filter Media

The Continental Air Filter media has honeycomb openings with large, non-clogging air passages (see sectional drawing). Result: Low resistance and unequalled efficiency in over-all performance.

Before you specify or buy, write us for this technical data booklet. It's just off the press . . and will help you compare. Use the coupon below. No obligation.

CONTINENTAL

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.

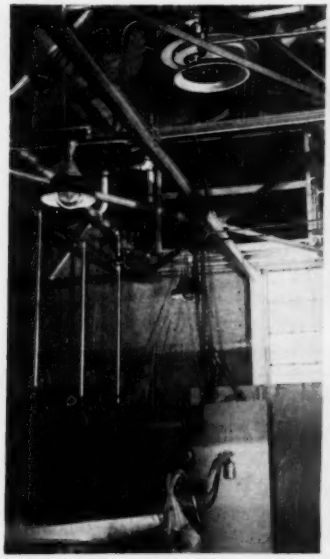
GENTLEMEN: Please send the following:
☐ New Bulletin No. 401-A
☐ Sample of E-Z-Wash Air Filter Media

NAME _____

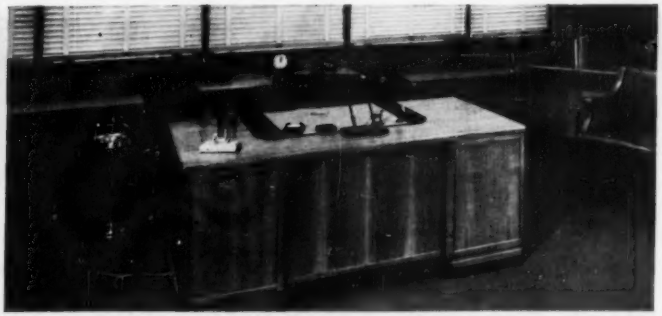
FIRM _____

STREET _____

CITY _____ STATE _____



Projection Heater features Louver Cone.



TRANE *Convectors provide clean, draftless heat for offices, schools, hospitals, homes.*

Unit Heater shows exclusive Louver Fin.

TRANE *Wall-Fin solves long run problems.*

How TRANE can help you build better heating into your next job

Your next job may be one with many *different* heating problems . . . long under-window runs, big lobbies, drafty halls. TRANE can help you solve them like this:

TRANE Unit Heaters put heat where you want it with vertical or horizontal air streams; gas, steam or hot water; free-delivery units or duct work; floor, wall or ceiling mounting . . . whatever your needs require.

TRANE Convectors blend with modern interiors; are available in ten distinct cabinet types—floor and wall hung models, sloping or flat tops, free-standing or recessed, hot water or steam.

TRANE Wall-Fin offers a third answer to your heating problems. From this complete line you can specify single or tiered elements, hot water or steam; with expanded metal grilles or handsome TRANE Wall-Fin Cabinets.

For complete information on these and other TRANE heating, ventilating and air conditioning equipment, see your TRANE sales engineer or write the TRANE Company at La Crosse, Wis.

TRANE

THE TRANE COMPANY, LA CROSSE, WIS.
Eastern Mfg. Division, Scranton, Pa.
Trane Company of Canada, Ltd., Toronto
Offices in 80 U.S. and 14 Canadian Cities

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

TRI-FLEX and AEROVANE REGISTERS

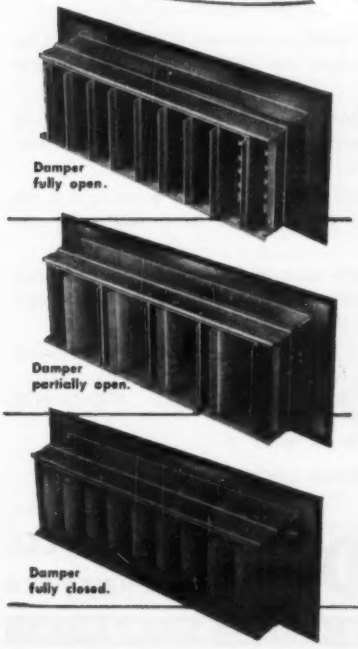
now equipped with

Opposed Blade Dampers

Showing TRI-FLEX T-647 Double Deflection Register with Opposed Blade Damper

KEY OPERATOR FOR OPPOSED BLADE DAMPER

Blades are regulated by key operator which may be removed or tapped permanently into place.



Damper fully open.

Damper partially open.

Damper fully closed.

TRI-FLEX Supply Air Registers and AEROVANE Return Air Registers — specified and installed on important air conditioning jobs — are now constructed with opposed blade dampers.

This improved damper unit insures uniform distribution of air over the entire face of the register . . . and provides positive damper setting in any position from fully open to fully closed regardless of system pressure. Set in a rigid steel frame, blades are formed for extra strength and stiffness, and overlap when closed, eliminating any possibility of air leakage. Blades are regulated through the face of the register by means of a key operator which may be removed or tapped permanently into place.

For complete information and size selection data for TRI-FLEX and AEROVANE Registers and Grilles, write for a copy of Catalog No. 200.

TUTTLE & BAILEY inc

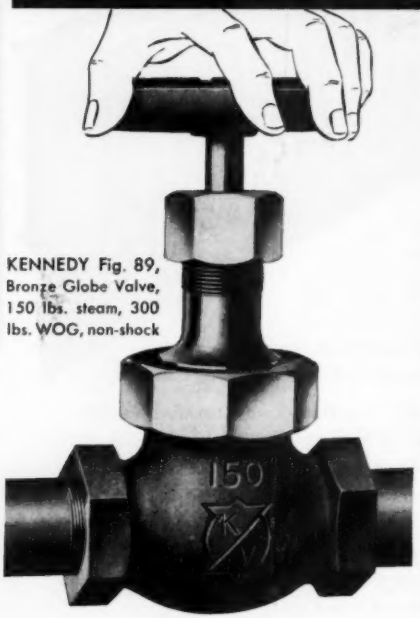
NEW BRITAIN, CONNECTICUT

KENNEDY

bronze globe valves...

SLIP-ON DISC HOLDER—This unique disc holder locks on securely wth stem in wide-open position . . . yet releases by a half-turn of the stem when bonnet assembly is removed.

JOB-FITTED for longer service... easier maintenance



KENNEDY Fig. 89, Bronze Globe Valve, 150 lbs. steam, 300 lbs. WOG, non-shock

YOU KEEP MAINTENANCE COSTS DOWN with KENNEDY Bronze Valves because they are *job-fitted* . . . every valve specially designed and engineered for the job it has to do.

THE KENNEDY FIG. 89, for example, is designed for services where frequent inspection, cleaning of internal parts and quick renewal of the composition disc are required.

HEAVY UNION BONNET RING permits easy dismantling and reassembly of the valve without risk of damage to body-bonnet bearing surfaces.

THE RENEWABLE COMPOSITION DISCS are available in a variety of materials to meet a wide range of fluid, pressure and temperature requirements.

RUGGED BODY has an unusually high seat to prolong disc life by utilizing full thickness of disc before disc-holder strikes the base of the raised seat.

LONG-WEARING PACKING—molded rings of lubricated asbestos—maintains easy operation and tight seal to prevent leaks. Valve can be repacked under pressure when wide open.

FOR BEST RESULTS and real economy, standardize on KENNEDY Bronze Valves . . . and the complete line of KENNEDY Iron Valves, Malleable, Cast-Iron and Bronze Pipe Fittings . . . WRITE FOR CIRCULAR 101.

BUY FROM YOUR LOCAL DISTRIBUTOR

KENNEDY JOB-FITTED VALVES

THE KENNEDY VALVE MFG. CO.
ELMIRA, NEW YORK

VALVES • PIPE FITTINGS • FIRE HYDRANTS

Packaging a "wonderdrug" under completely sterile conditions. Copper and brass play an important part in equipment.

"Wonder Drug" production

highlights vital role of

Powerful antibiotics produced from mold cultures have been perfected which are proving highly effective in combating blood poisoning, virus and bacterial pneumonia, whooping cough, strep throat, typhus and many other diseases which have plagued humanity for centuries. Sterile conditions and purity are constants which are maintained in their manufacture largely through specialized equipment which is highly dependent upon copper and copper base alloys. Pumps, compressors, after-coolers, evaporators, distillation towers and many other types of equipment used in the process depend upon the corrosion resistance, high thermal conductivity or inertness of copper and copper alloys. In vital roles such as these, HUSSEY COPPER plays an important part . . . one of America's most distinguished commercial metals since 1848.

HUSSEY COPPER and Brass

C. G. HUSSEY & COMPANY
(Division of Copper Range Co.)
ROLLING MILLS AND GENERAL OFFICES
PITTSBURGH 19, PA.

7 Convenient Warehouses to serve you:

PITTSBURGH (19)
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CLEVELAND (14)
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HUSSEY

CHICAGO (18)
3900 N. Elston Avenue

ST. LOUIS (3)
1620 Delmar Boulevard

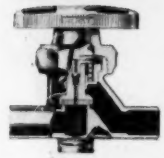
PHILADELPHIA (30)
1632 Fairmount Avenue

CINCINNATI (2)
424 Commercial Square

HENRY LINE VALVES really give you something extra

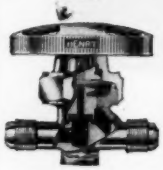
They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES
FOR FREON
with Exclusive Balanced-Action



STANDARD TYPE

Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru 1" F.P.T.



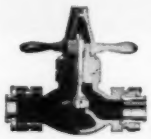
BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

PACKED VALVES
FOR FREON
Bronze-Wing Cap Type

Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

SEMI-STEEL WING CAP TYPE



With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".

Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

PACKED VALVES
FOR AMMONIA
Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.

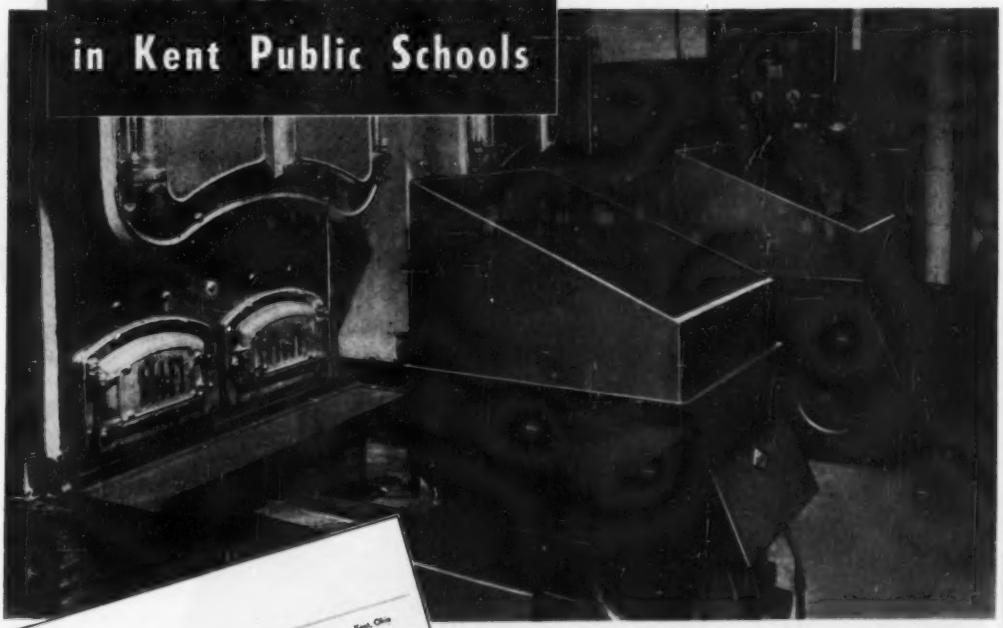
HENRY VALVE CO. CONTROLLING FLOW SINCE 1914

Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

®

An A+ for WILL-BURT stokers in Kent Public Schools



KENT PUBLIC SCHOOLS

H. P. Smith, Superintendent — Kent, Ohio

Will-Burt Stoker Company
Orrville
Ohio

Gentlemen:

I wish to tell you how pleased we are with our Will-Burt stoker equipment. We have had one unit in an elementary building for ten years with no trouble. Another elementary installation of three years has functioned perfectly. The dual stokers installed in our Roosevelt building in the Fall of 1950 have done well. We are proud of this installation and recommend Will-Burt to all interested in stoker equipment.

Cordially yours,

H. P. Smith
Superintendent

Since the original Will-Burt installation many years ago, Kent (Ohio) Public Schools have installed three additional Will-Burt stokers. The latest, a dual installation at Roosevelt High School, is shown above.

Why were Will-Burt stokers specified each time? Because they had proved their economy . . . trouble-free operation . . . and year-in year-out dependable performance. Yes, if stokers were rated like students, there'd be a big A+ for Will-Burt at the Kent Public Schools.

Engineers and contractors have found it pays to specify Will-Burt. More good words from the customer — paving the way to future jobs.

Write today for facts on the Will-Burt line.

WILL-BURT

THE WILL-BURT COMPANY

DEPARTMENT H ORRVILLE, OHIO

STOKERS • RESIDENTIAL BOILERS • OIL AND GAS CONVERSION BURNERS

WHAT *Life-Lines* REALLY DELIVER IS MORE SERVICE...LESS SERVICING

How to spot a truly pre-lubricated motor

You are looking at the first motor made to utilize pre-lubrication to its *utmost.* Notice the bearing hub. It was *designed* for a pre-lubricated bearing. There are *no* grease fittings or plugs. The way to grease this modern motor is *don't.*

Westinghouse—the pioneer in pre-lubricated motors—announced in 1948, after 15 years of tests in the laboratory and on the job throughout industry, that Life-Line motors needed no further lubrication. That meant what it said; still means it. You don't have to lubricate them in six months or six years. You don't have to lubricate them—period!

This means you can't grease a Life-Line motor incorrectly. No chance to push dirt into bearings . . . to force grease through seals and into windings. No chance for greasing errors at all! Lubrication problems are out.

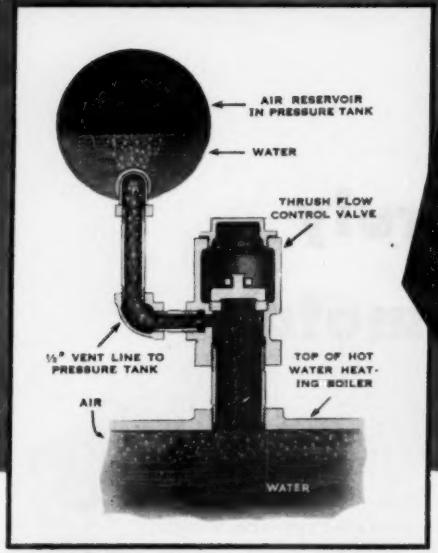
So be sure you get a truly pre-lubricated motor. Look for one that has no grease fittings. You'll know then it means what it says and needs no greasing attention. You'll find your answer in Life-Lines. Remember this is but one reason why Life-Lines offer you more service on the job . . . less servicing.

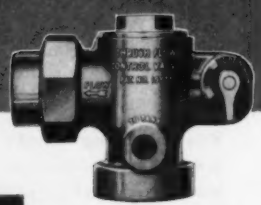
Ask your Westinghouse representative about other reasons—all steel construction and greater electrical strength. And ask for a free copy of "Facts on Pre-Lubricated Bearings" (B-4378), or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21705-A

YOU CAN BE SURE... IF IT'S

Westinghouse

End AIR Troubles with THRUSH FLOW CONTROL VALVES

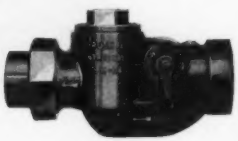




Angle Flow Control Valve

Vertical Flow Control Valve with air tube

Horizontal Valve for zoning



HAVING TROUBLE with air in hot water heating systems? Then you need Thrush Flow Control Valves with air tubes. Even a little air reduces efficiency of convectors, radiators or coils because of the limited volume of water in a modern hot water heating system. Air from the boiler passes up outside the air tube into the Thrush Flow Control Valve and is kept out of the system.

The Thrush Flow Control Valve is used with the Thrush Water Circulator to provide positive control of circulation and prevent overheating. Water is passed through the valve to the heating units only when heat is needed. Various types and sizes permit quick, low cost installation on any job. Ask your wholesaler about them today or write Department E-12.

Thrush Water Circulator

H. A. THRUSH & COMPANY
PERU • INDIANA

For small pipe heating systems

U·S·S Galvanized Steel Sheets

SMALL diameter pipes are one of the newest trends in warm air heating installations. Many contractors are finding this system makes it easier to sell modernization jobs where space is at a premium.

In installing small pipe systems—as well as conventional ductwork arrangements—contractors find they can do their best jobs with U·S·S Galvanized Steel Sheets. These sheets can be rolled, bent, cut, formed and soldered without difficulty. And the zinc coating gives the installation lasting protection against rust and corrosion.

For the finest performance, both in fabrication and service, use U·S·S Galvanized Steel Sheets. Your customers know the United States Steel name. . . they recognize that it stands for the best in steel.

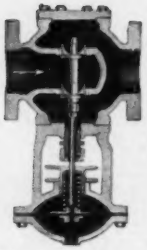
U·S·S GALVANIZED STEEL SHEETS

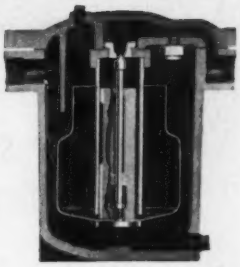
UNITED STATES STEEL COMPANY, PITTSBURGH • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

2-1645

UNITED STATES STEEL

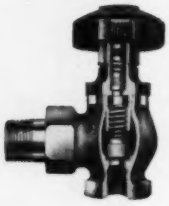


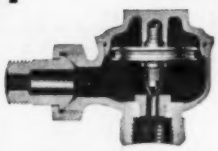


ILLINOIS

Automatic

Steam and Fluid Control Equipment





Illinois Control Equipment includes Combustion Control, Flow Control (electrical or pneumatic), Zone Control and a complete line of steam heating and power specialties for heating comfort and fuel saving and for industrial process control as well.

"ILLINOIS" is your logical, dependable source of supply for heating and power specialties that have been carefully engineered, thoroughly proved and have a performance record that is beyond question.

Our representative nearest you in our nation-wide service will give you full information.

Write for Bulletins

ILLINOIS ENGINEERING COMPANY

INCORPORATED 1900

RACINE AVENUE AT 21ST STREET • CHICAGO 8

Design Engineers: Abbott, Merkt and Company, Inc.
Design Architects: Kahn and Jacobs
Consulting Engineers: Edward E. Ashley

NEW HECHT STORE *chooses...*

●Handsome efficient Kno-Draft Air Diffusers bring conditioned air – gently, evenly, and *without drafts* – into The Hecht Co.'s new Parkington-Arlington store at Arlington, Virginia.

Here, as with every Kno-Draft job, a lot less preliminary figuring had to be done because Kno-Draft Air Diffusers are adjustable *after* installation. This not only reduces slide rule work but assures the customer the exact comfort level desired. Air volume and direction of flow can be regulated with no other tool than a screw driver.

Kno-Draft *Adjustable* Air Diffusers are being specified for more and more commercial and industrial applications. Get the full story on their many engineering advantages. Mail the coupon today to W. B. Connor Engineering Corporation, Danbury, Connecticut.

CONNOR

kno·draft®

adjustable air diffusers

W. B. CONNOR ENGINEERING CORP.
Dept. G-122, Danbury, Connecticut

Please send me the *new edition* of the Kno-Draft Data Book—without obligation, of course.

Name_____

Position_____

Company_____

Street_____

City_____ Zone____ State_____

ROCHESTER GAS & ELECTRIC SPECIFIES . . . .

GUN-PAKT EXPANSION JOINTS

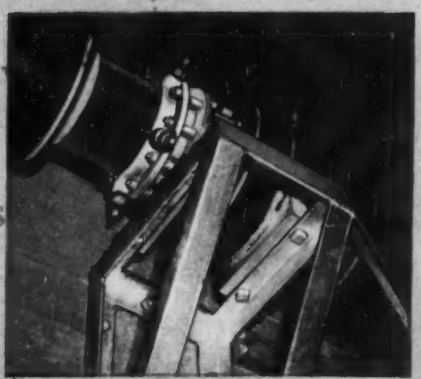
USER OF GUN-PAKT JOINTS SINCE 1935 ORDERS 16 MORE FOR NEW STEAM LINE

This prominent New York State utility has been using Yarway Gun-Pakt Expansion Joints for the past 17 years. Now they have ordered 16 more (12", max. working pressure 400 psi) for a new steam distribution line in their expanding system—pretty good proof that Gun-Pakt Joints give trouble-free, economical service.

Central station heating plants, institutions and industrial plants all over the country are finding Gun-Pakt Joints offer *maximum protection* with *minimum maintenance*. Gun-Pakt Joints are *rugged, strong* joints. They offer freedom from shutdowns because they are *serviced under full steam pressure*. Maintenance costs are low; one utility that kept accurate records found their maintenance costs to be only 65c per year per joint!

To service a Gun-Pakt Joint you simply insert a plug of packing, twist a wrench, and the joint is tight . . . the job done . . . all without taking pressure off the line.

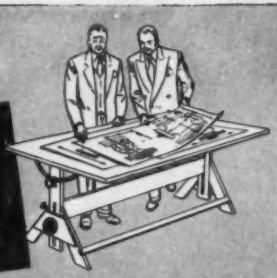
Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Call on your Yarway man for friendly, helpful advice.



Yarway Gun-Pakt Expansion Joint installed in Rochester Gas & Electric Corporation's Broad St. subway line. 10" joint, 228 lbs. pressure, 450°F.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
Branches in principal cities

YARWAY SERVICE GOES ALL THE WAY . . .



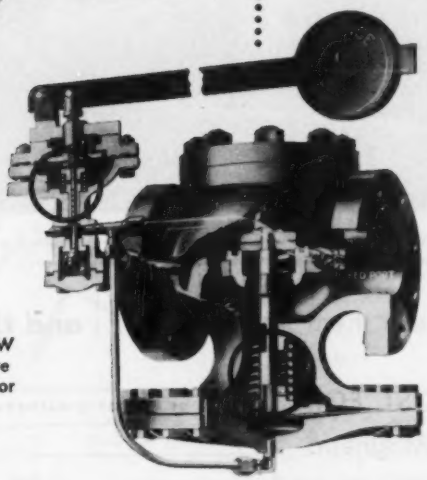
HOW SPENCE DESIGN...

...protects springs

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type EW Pressure Regulator

A few other design features:

SECO METAL SEATS AND DISCS—Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

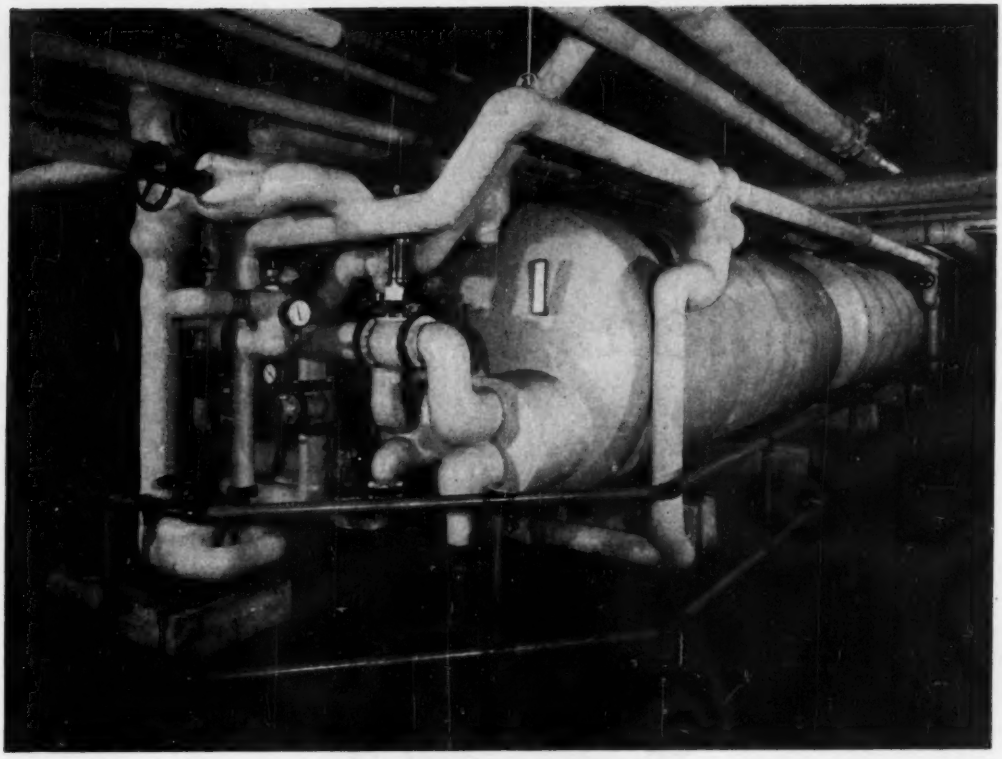
LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

SPENCE ENGINEERING COMPANY, INC.

WALDEN, NEW YORK



Hot water tanks and steam connections, Chicago Athletic Club, Chicago, Ill., with lifetime insulation of "Featherweight" 85% Magnesia. **Plumbing Contractor:** W. W. Watson Co. **Insulation Contractor:** Standard Asbestos Co. of Chicago

This insulation keeps them in hot water... **and they love it!**

ANOTHER BOOST FOR "Featherweight" 85% Magnesia

When a user is spending money to heat water, he wants it to stay hot *until he needs it*—and that's where "Featherweight" 85% Magnesia will do just that.

Take this installation, for example. "Featherweight" 85% Magnesia completely insulates those big tanks, and holds the heat so well that loss from radiation is at a minimum.

You can get and hold business with performance like that!

And this insulation is permanent . . . because "Featherweight" holds up—and will not deteriorate and lose its efficiency.

You don't have to *baby* "Featherweight", either—it's light, yet rugged. And it's easy to apply . . . fits snugly to contours, can be sawed or cut, and goes on quickly. You can get it in all forms, too—blocks for flat, curved, and irregular surfaces; in sections and sets of segments for standard pipe sizes.

In fact, you'll find the whole line of K&M Low Pressure Insulations, shown in the table at right, equips you to handle any insulation requirement. Write for further information regarding these insulations.

RANGES OF KEASBEY & MATTISON LOW PRESSURE INSULATIONS

INSULATION	50°F	100°F	200°F	300°F	400°F	500°F	600°F
DUPLEX							
AIR CELL							
FINE CORRUGATED AIR CELL							
SPECIAL FINE CORRUGATED AIR CELL							
SIMPLEX "SUPER SHRUNK"							
"FEATHERWEIGHT" 85% MAGNESIA							

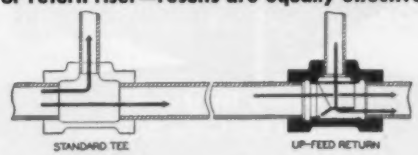
K&M best in asbestos

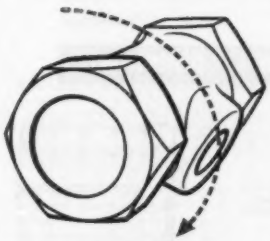
Nature made Asbestos . . .
Keasbey & Mattison has made it serve mankind since 1873

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

ONLY ONE MONOFLO FITTING NEEDED FOR MOST INSTALLATIONS

Install a Monoflo Fitting at either the supply or return riser—results are equally effective





Special Down-feed Fittings eliminated

Different Monoflo Fittings for up-feed and down-feed radiators are not required. By *revolving* either a Supply Fitting or Return Fitting so that the riser opening is down, it can be used for down-feed radiators.

B & G Monoflo Fittings enable you to design a forced hot water system with assurance that it will be correctly and efficiently circulated. That's because the Monoflo Fitting is an *engineered* device—not just a "scoop" or "choke."

Under average conditions, *a single Monoflo provides ample diversion capacity!* In abnormally long pipe runs or where unusually large heating loads must be handled, a Monoflo Fitting may be required at both supply and return risers. Down-feed radiation likewise requires two Fittings.

Here's the important point! It would be no trick at all to build enough resistance into Monoflo Fittings so that one fitting would be sufficient under all circumstances. But remember this...*every average job would then be penalized with excessive resistance!* This is particularly true in large installations.

So why waste power...why over-circulate one radiator in order to properly supply another...why take a chance on a noisy system because of excessive water velocity. Use B & G Monoflo Fittings—*correctly designed for most efficient performance!*

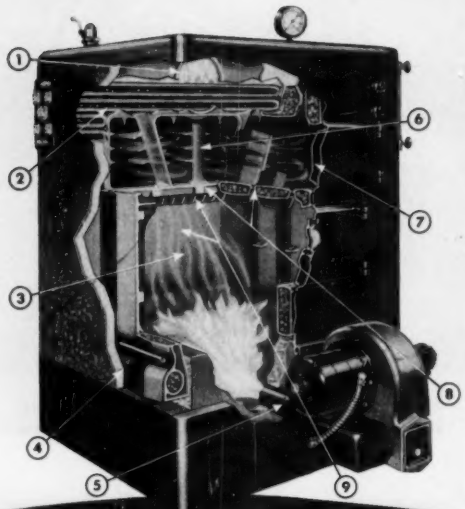
Send for Bulletin DF-450 giving simplified Monoflo Design Table for smaller installations.

BELL & GOSSETT
COMPANY
Dept. CT-5, Morton Grove, Ill.

Canadian License: S. A. Armstrong Ltd., 1400 O'Connor Drive, Toronto, Canada

AMERICAN-Standard
HEATING

Engineered to solve the heating problems of larger homes



Features That Assure
Dependable Fuel-Saving Operation

Exbrook Boiler

FOR OIL OR STOKER FIRING

● Designed exclusively for automatic firing with coal or oil, the Exbrook is ideally suited for larger homes, or small to medium sized apartment and other buildings. Made of durable cast iron to give long-lasting service, this efficient boiler is noted for its dependable operation. A careful check of the features listed below will show you why the Exbrook may be just the answer to your heating problems. The Exbrook and other larger-than-average-capacity boilers in the American-Standard line are sold through selected wholesale distributors to heating contractors.

1. EXTRA LARGE NIPPLES—extend below water line and assure free and rapid circulation of boiler water and quick heat response. Also permit use of a built-in or external water heater.

2. BUILT-IN WATER HEATER—Tank or tankless type is available on oil boilers at small extra cost for providing year 'round hot water.

3. COMBUSTION SPACE—adequate in size, correctly proportioned and air-tight for burning fuel efficiently and economically.

4. INSULATION—suitable insulating material underneath attractive metal jacket helps prevent heat loss and keeps jacket cool.

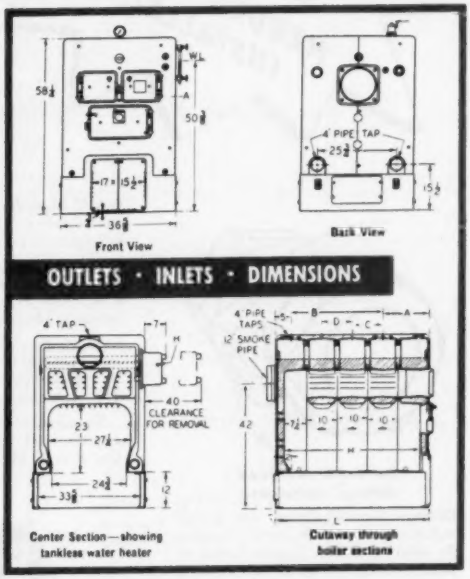
5. OIL BURNER—a perfectly matched, flange mounted Arcoflame Oil Burner with its famous fuel-saving "sunflower" flame, is shown. Base plate also permits easy installation of stoker.

6. MULTI-FINNED FLUES—provide long flue travel with maximum surface for extracting available heat from hot gases, for peak efficiency and economy.

7. STURDY, HEAT-PROTECTED DOORS—clean-out and fire doors of heavy construction have cast iron baffle linings to protect them against warping.

8. TIGHT JOINTS—where sections and doors contact other surfaces they are machine ground to form tight joints and close fit. This prevents short circuiting of gases, uncontrolled infiltration of air and escape of odors.

9. DIRECT HEATING SURFACE—ample finned heat-absorbing surface exposed directly to fire, for extra efficiency.



American Radiator & Standard Sanitary Corporation, P. O. Box 1226, Pittsburgh 30, Pa.

Serving home and industry

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILERS • ROSS HEATER • TONAWANDA IRON

Free Engineering Data

on BOILER FEED and CONDENSATE RETURN SYSTEMS

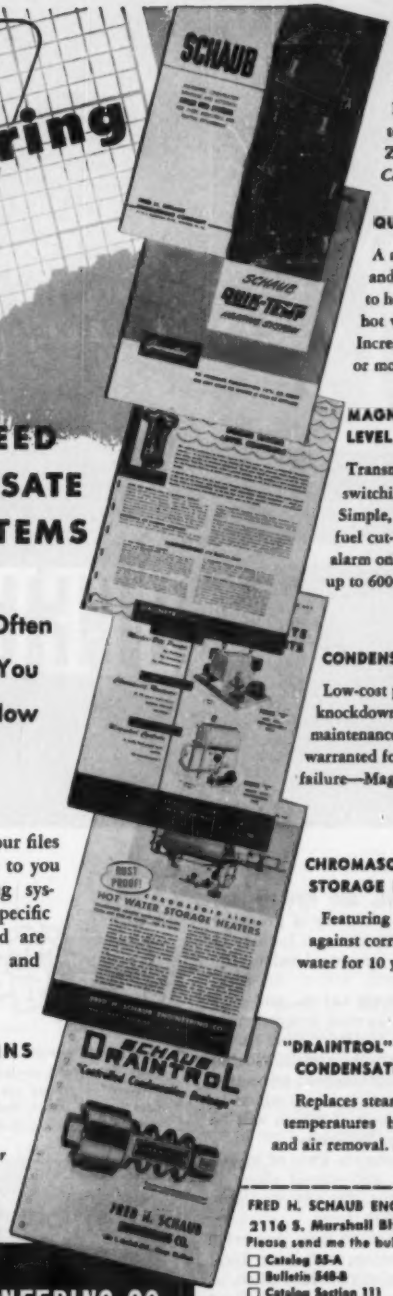
Information That is Often Hard to Find When You Need it . . . Get it Now and Keep it Handy

This information belongs in your files It will be of inestimable help to you when planning or specifying systems or components to do specific jobs most efficiently. Included are complete engineering data and specifications on:

ENGINEERING BULLETINS

"A Discussion of Deaerator Design Principles," covering design intent, basic requirements, and other considerations. *Engineering Bulletin 570.*

Engineering Notes for Storage Hot Water Heaters. How to determine the proper heater for specific applications. *Engineering Bulletin No. 911.*



ENGINEERED CONDENSATION DRAINAGE AND AUTOMATIC BOILER FEED SYSTEMS:

Standard boiler return systems—Free-Heet Systems—Heat reclaim systems—Spray type deaerating systems—Zero oxygen deaerating systems. *Catalog 55-A.*

QUIK-TEMP HEATING SYSTEMS:

A method of continuous stream circulation and air removal that permits machines to heat almost instantly and keeps them hot with minimum effect from load change. Increases production potential 10% or more. *Bulletin 548-B*

MAGNETROL BOILER WATER LEVEL CONTROLS:

Transmits changes in water level to the switching mechanism by magnetic action. Simple, fool-proof, positive. May be used for fuel cut-off and alarm, cut-off only or alarm only. Models for all steam pressures up to 600 pounds. *Catalog Section 111.*

CONDENSATE RETURN SYSTEMS:

Low-cost prefabricated type and heavy duty knockdown type. Featuring Master-Bilt maintenance-free pumps—Chromasoid receivers, warranted for 10 years against internal corrosion failure—Magnetrol controls. *Bulletin 655.*

CHROMASOID LINED HOT WATER STORAGE HEATERS:

Featuring Chromasoid lined tanks guaranteed against corrosion failure from any kind of water for 10 years. *Bulletin 910.*

"DRAINTROL" FOR CONTROLLED CONDENSATION DRAINAGE:

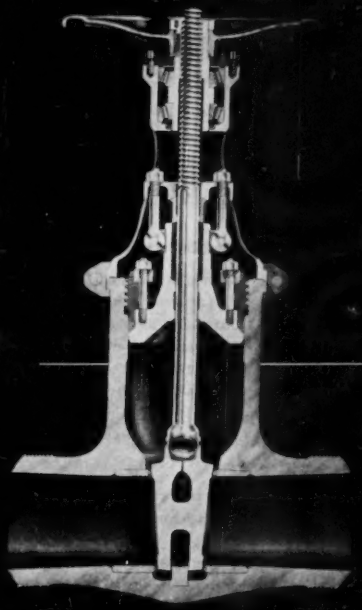
Replaces steam traps. Enables higher surface temperatures by continuous condensation drainage and air removal. *Bulletin 642.*

FRED H. SCHAUB ENGINEERING CO.
2116 SO. MARSHALL BLVD.
CHICAGO 23, ILLINOIS

FRED H. SCHAUB ENGINEERING CO.
2116 S. Marshall Blvd., Chicago 23, Ill.
Please send me the bulletins checked below:

- ☐ Catalog 55-A
- ☐ Bulletin 548-B
- ☐ Catalog Section 111
- ☐ Engineering Bulletin 570
- ☐ Bulletin 655
- ☐ Bulletin 910
- ☐ Bulletin 642
- ☐ Engineering Bulletin 911

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____



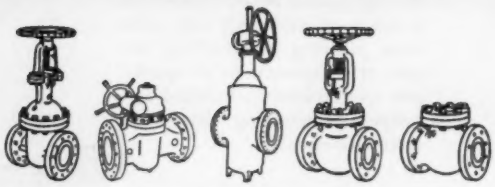
STEEL

COMPLETE LINES OF CAST STEEL VALVES AND PIPE FITTINGS are manufactured by Walworth in a variety of pressure classes, types, sizes, and patterns for general industrial use. Walworth also manufactures cast steel valves for specific service applications.

Walworth produces steel bar stock valves, and cast steel valves made of carbon steel, carbon molybdenum steel, corrosion-resistant, and heat-resistant alloy steels. Included are gate, globe, angle, check, and lubricated plug types. Sizes range from ⅛ to 30 inches; pressures range up to 5,000 psi. Full information is contained in Walworth General Catalog 52, a copy of which will be forwarded if requested on business letterhead.

Walworth also manufactures complete lines of valves and fittings made of bronze, iron, and special alloys as well as steel. Walworth-made valves, fittings, and pipe wrenches total approximately 50,000 items.

Walworth engineers will be glad to help you with your problems. For full information, call your local Walworth distributor, nearest Walworth sales office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, New York.



Illustrated in section is an 8-inch Series 900, Walworth Pressure-Seal Cast Steel Gate Valve designed for high-pressure, high-temperature service. Pressure-Seal Valves are available in Series 600, 900, 1500 and 2500; sizes 1 to 16 inches. Small Cast Steel Valves, Series 1500, in angle and Y-globe types, are also available in sizes ranging from ¼ to 2 inches.

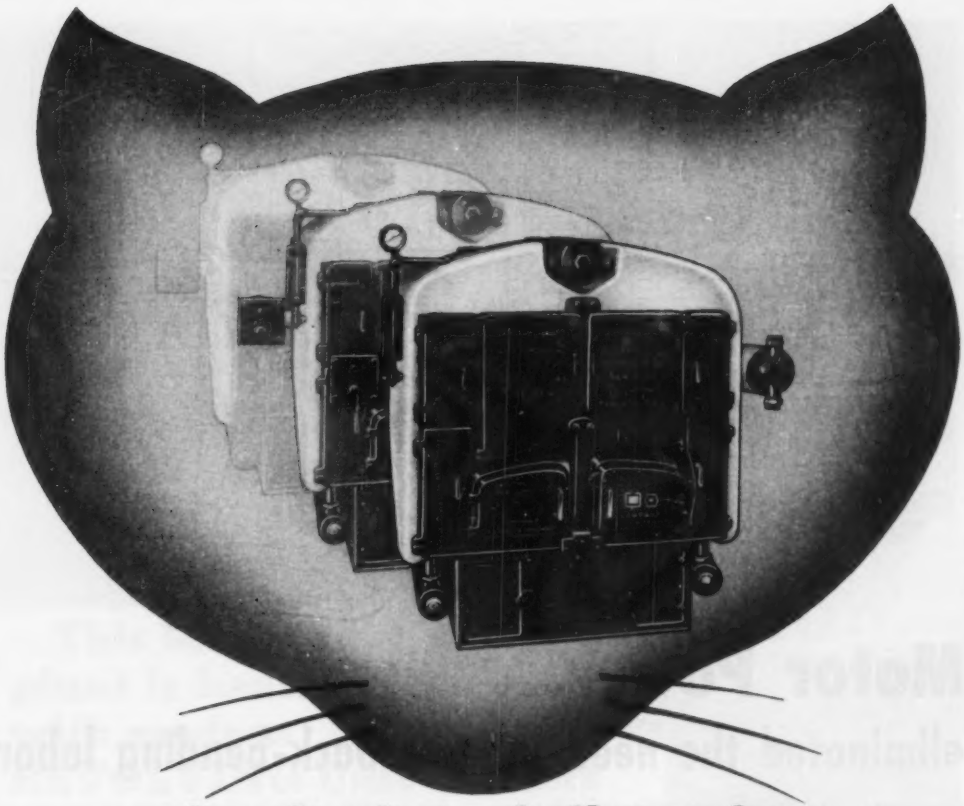
WALWORTH

Manufacturers since 1842

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD



when buying a boiler today

would you settle for 3 lives?

If history means anything, the H. B. Smith Boiler you install today will be on the job when the year 2000 is born! That's because H. B. Smith Boilers are made of cast iron — universally acknowledged to have the longest life in boiler service. Furthermore, H. B. Smith Boilers are made of the *highest quality* cast iron, with self-cleaning vertical water tube construction that promotes top efficiency with least maintenance.

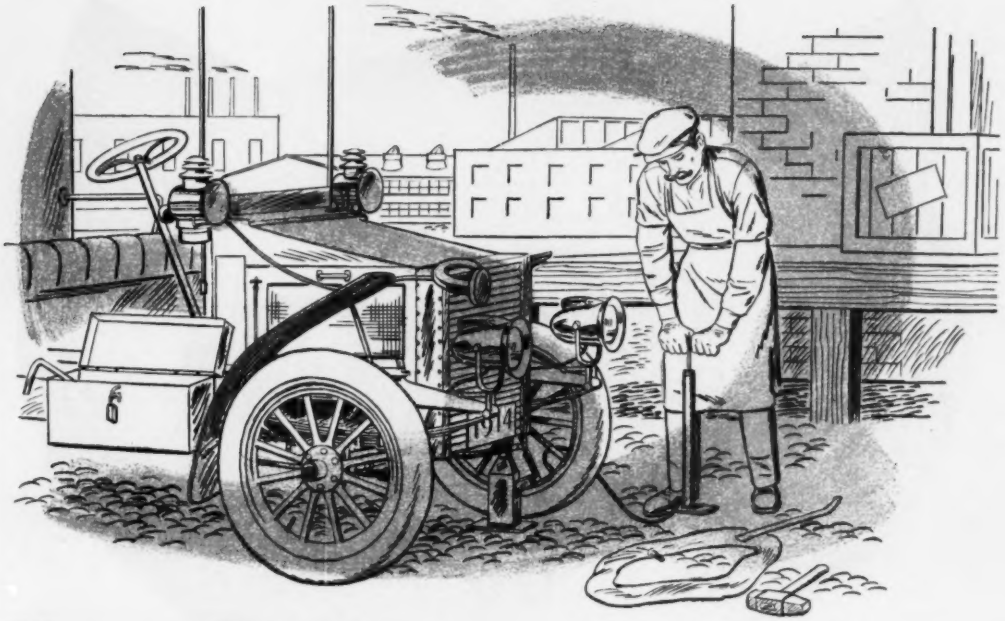
It's no secret that most conventional boilers used in larger buildings have a life expectancy of about 20 years. Whereas thousands of H. B. Smith Cast Iron Boilers have been in constant service for 40, 50 — yes, even for 60 years, without ever a major repair.

Settle on an H. B. Smith Cast Iron Boiler today, and you're all *settled* for tomorrow.

H. B. Smith CAST IRON BOILERS

A CENTURY IN '53

The H. B. Smith Company, Inc., Westfield, Massachusetts



Motor Power...

eliminated the need for this back-bending labor!

Compressed air, used in numerous industrial applications to lift, move, clean and spray, also provides the riding cushion for millions of vehicles.

Powerful, efficient compressors, equipped with specially adapted motors, make this commodity an important and useful tool for industry. Car-owning families are patrons of "free-air" service, made available through America's 190,000 filling stations, thanks to that same number of dependable air compressors.

Emerson-Electric Motors were first used on air compressors in 1899, and the progress of the industry has been matched with improvements in the motor drives.

Emerson-Electric builds dependable, efficient motors for equipment used in industry, in business, on the farm and in the home. There is a complete line of Emerson-Electric standard motors in horsepower ratings from 1/20 to 5, and hermetic motor parts in ratings from 1/8 to 15 horsepower. Your inquiry is invited.

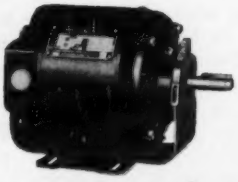
The EMERSON ELECTRIC Mfg. Co., St. Louis 21, Mo.

MODERN INDUSTRY **IS POWERED WITH** ELECTRIC MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

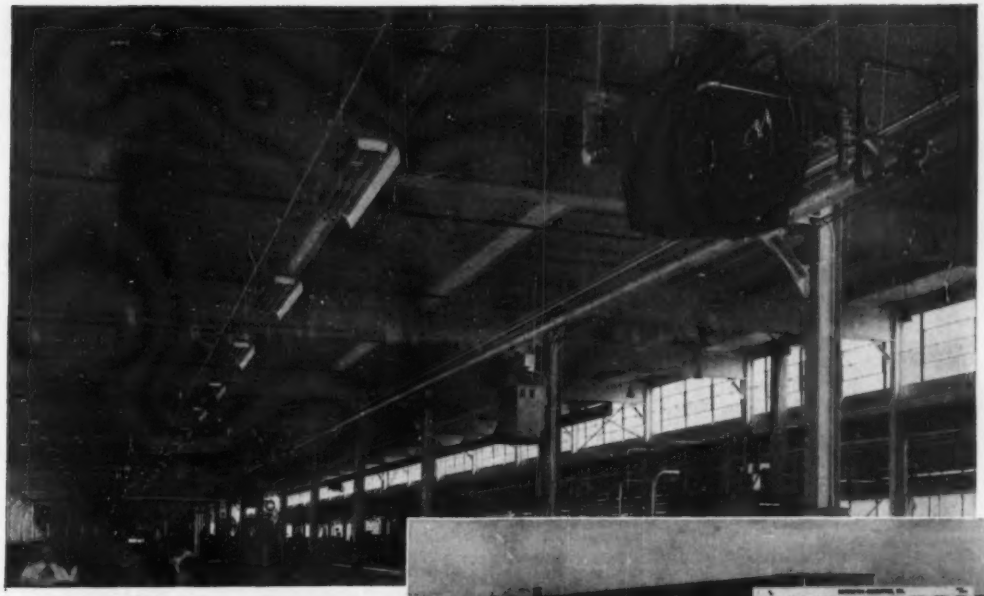
- ☐ M155-A Capacitor-Start
- ☐ M155-B Split-Phase
- ☐ M155-C Integral
- ☐ M155-D Fan-Duty
- ☐ M155-E Oil-Burner
- ☐ M155-F Jet Pump
- ☐ M155-G Blower

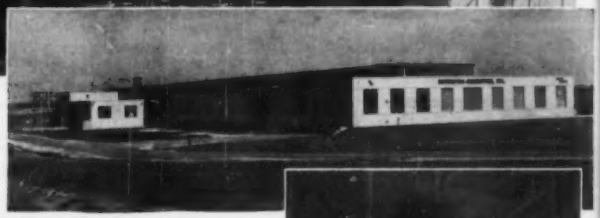


Curtis Pneumatic Mach'y Div. of Curtis Mfg. Co., St. Louis, a leading air compressor manufacturer since 1896, is a user of Emerson-Electric Motors.

EMERSON ELECTRIC
MOTORS • FANS APPLIANCES

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890





This modern plant is heated with modern REVOLVING Unit Heaters

The Crawfordsville, Indiana plant of Raybestos-Manhattan, Inc., one of the country's leading manufacturers of asbestos and rubber products is an example of a modern carefully planned industrial building, laid out for highest efficiency in manufacturing. Typical of the equipment selected with this end in view are the Wing Revolving Unit Heaters. These heaters, by distributing the heated air downwards in a constantly changing direction, keep the workers comfortably warm and invigorated, without subjecting them to constant blasts of hot air or chilly drafts. Wing Revolving Unit Heaters are worth a great deal from the standpoint of employee relations alone.

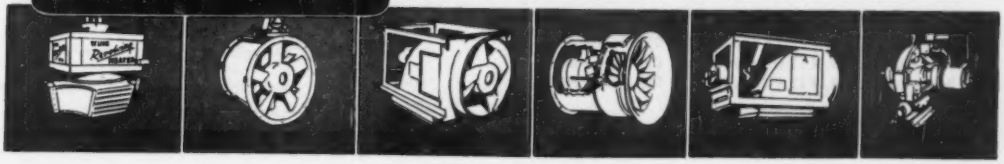
The discharge outlets of the Wing Revolving Unit Heaters revolve slowly, distributing the heated air downwards in gently moving streams, that can be adjusted for different shapes of areas to be covered. In the summer time, with the heat turned off they act as a perfect air cooling system.

Wing

REVOLVING UNIT HEATERS

L. J. Wing Mfg. Co. 140 Vreeland Mills Road, Linden, N.J.

Factories, Linden, N.J. and Montreal, Canada
In Europe: Establissements WANSON, Haren-Nord, Brussels, Belgium



are you a Rainmaker?

Vapor flows through Plaster, through Asphalt, into ordinary insulation and condenses. Also condenses on inner surface of cold outer walls and roofs.

If you permit vapor to strike the cold under-surface of a cold roof which continuously extracts heat from the contacting air beneath it by conduction, you will produce rain or condensation. In conduction, the flow is always from warm to cold. The same principle applies to any cold mass, including a mass above a ceiling which continuously extracts heat from ever-present contacting air and lowers its dewpoint.

Asphalt-coated papers permit vapor to pass through. At zero degrees, vapor, which is a gas, has almost one-millionth the density of water. Vapor flows through wood, plaster, stone, ordinary insulation, and most so called "vapor barriers," if they are not metal.

In winter, the crowded store, school or auditorium, and the home whose atmosphere is saturated with vapor from cooking, laundry, baths, humans, pets, create vexing condensation problems. Air-conditioned structures are also susceptible in summer as warm, moist, outside air comes into contact with cooler interior surfaces.

Thick, accordion multiple aluminum sheets have zero permeability to vapor. They will also gradually expel fortuitous vapors through exterior walls and roofs which (if not metal) have much greater permeability. They are non-condensation forming and can retain no moisture.

How effective is multiple accordion aluminum in winter-conserving or summer-repelling of heat? See Table of Thermal Values below. For additional facts on heat and vapor flow and on condensation, consult Schwartz's "Simplified Physics of Vapor and Thermal Insulation" and the U.S. Bureau of Standards report: "Moisture Condensation in Building Walls." Either or both sent free on request.

Available commercial forms of multiple accordion aluminum, are Infra Insulation Types 6, 4 and 4 Jr.

INFRA INSULATION, Inc., 525 Broadway, New York

THERMAL FACTORS, TYPE 6 INFRA

Up-Heat C.089, R11.23 equals 4⅘" DRY Rockwool
Wall-Heat C.073, R13.69 equals 5⅗" DRY Rockwool
Down Heat C.044, R22.72 equals 9" DRY Rockwool

Infra Insulation, Inc., 525 B'way, N. Y. Dept. H-12
Please send me free ☐ Schwartz's Simplified Physics:
☐ U. S. Booklet: ☐ Samples: ☐ Price schedules
Name_____
Address_____
Firm_____

THE EDITOR'S PAGES

BIG ONE COMING — Next month's issue of Heating, Piping & Air Conditioning will include the new Directory Section (a regular feature of each January's HPAC), a big Show Section previewing the International Heating, Ventilating & Air Conditioning Exposition, and of course our regular editorial content (including the Journal Section of the American Society of Heating and Ventilating Engineers).

DIRECTORY SECTION A BIG EDITORIAL JOB

THE COMPLETE Directory Section of Heating, Piping and Air Conditioning Equipment for Industrial, Commercial, Institutional and Public Buildings — thoroughly revised and brought up-to-date — to appear for the 19th consecutive year in the January HPAC is a big editorial job.

Thousands of listing sheets have been mailed to the manufacturers of the hundreds of items of equipment used in heating, piping and air conditioning installations in plants and big buildings for the latest authoritative information on what will be available where during 1953. The information will be carefully classified for your use, along with the manufacturers' complete street addresses and trade names.

To all those who are cooperating with us in assuring the accuracy and completeness of the listings, we wish to express our thanks.

INDEX FOR 1952 TO BE AVAILABLE ON REQUEST

AN INDEX FOR HPAC's 1952 issues, Vol. 24, Nos. 1-12, including the Journal Section of the American Society of Heating and Ventilating Engineers, is being compiled and will be available after the first of the year to HPAC's subscribers on request. If you want a free copy, send a note or postcard to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We'll keep your request on file until the index has been printed, and will then mail a copy to you.

CHICAGO EXPOSITION OFFERS ADDITIONAL SPACE

THE 11TH INTERNATIONAL Heating, Ventilating and Air Conditioning Exposition, scheduled for the International Amphitheatre, Chicago, January 26-30, has announced the availability of additional exhibit space. The demand for space has far exceeded previous expositions, and the forthcoming event already occupies the entire first floor of the amphitheatre and the north wing of the second floor.

The new area is in the south wing of the second floor and in the connecting passageway between the north and south wings.

Largest event of its kind ever held, the exposition will include some 400 displays of leading manufacturers. Inquiries concerning exhibit space should be directed to the exposition at Grand Central Palace, New York 17, N. Y., the permanent headquarters Charles F. Roth is manager of the exposition and E. K. Stevens is associate manager.

NPA ANNOUNCES RELAXATION OF CONSTRUCTION ORDERS

RELAXATIONS OF construction regulations which will become effective May 1, 1953, and will increase quantities of controlled materials that may be self-authorized for most types of construction, while liberalizing the rules on residential, recreational, entertainment and amusement construction, have been announced by the National Production Authority.

To provide for the future relaxations, a new direction 8 to revised CMP regulation 6, the basic construction order, was issued by NPA.

In announcing the relaxations, the NPA administrator said the possibility of advancing their effective date will be considered further.

J. C. JOHNSON — OIL BURNER PIONEER — DIES

J. C. JOHNSON — president of the S. T. Johnson Co., which he founded with his brother in 1903, and a pioneer in the oil burner industry — died recently following injuries incurred in an accidental fall at his country home.

Mr. Johnson was an active and effective figure in the early struggle to gain acceptance and recognition for the oil heating industry. He helped form the earliest industry associations, and in 1928 he served as president of the American Oil Burner Association. His faithful attendance at conventions was almost a tradition.

GAS INDUSTRY SEES CONTINUING EXPANSION

ABOUT 800,000 NEW customers will be added to those already being served by gas, while $1 billion will be invested this year by the $12 billion gas industry, Frank C. Smith, president of the Houston Natural Gas Corp., told the American Gas Association's 34th annual convention at Atlantic City.

More than 8000 delegates from gas utilities, gas appliance manufacturers and dealers at the meeting reviewed the progress the industry has made in the past year and charted paths for the expansion that lies ahead.

The gas industry ranks sixth among the nation's industries from the standpoint of invested capital. Its gas transmission and distribution companies have announced plans to spend more than $5.6 billion in constructing new plant and expanding present facilities in the five years through 1956.

The gas industry has added more than 800,000 new customers per year for the past three years. The AGA's estimates indicate that this rate of customer increase will accelerate as the nation's natural gas transmission systems continue to spread.

Statistics showing that natural gas "supplies will be maintained well beyond the present century," were cited by Dr. Gustav Egloff, research director of Universal Oil Products Co. He interpreted such reserves as meeting all demands and upholding "the favorable competitive position of the industry" in the fuel field far into the future.

Much of the continuing increase in the use of natural gas, said Dr. Egloff, most likely will be "in the fields of space heating, cooking, heat treating and chemicals production." He added that close to a million homes installed gas heating facilities during the 1951-52 heating season and another 1,100,000 new customers are anticipated for 1952-53.

"The greatest increase in natural gas use from 1951 to 1975" was foreseen by Dr. Egloff "in residential heating where the demand is expected to rise from 1.5 to 4.2 trillion cu ft." He said "the growth of the natural gas industry will depend to a considerable extent upon the increasing use of natural gas in space heating."

In the industrial field Dr. Egloff said that more than 50,000 factories were using natural gas in 1951, double the number in 1941. The use increased from 1 trillion cu ft in 1932 to 3.392 trillion cu ft in 1951, he said.

Coordinated with the AGA convention was the largest exhibit of gas appliances and equipment ever staged by the Gas Appliance Manufacturers Association. More than 170 manufacturers of gas equipment exhibited, and displays of heating equipment were a dominant theme of the show.

PLAN HEARING ON SNOW MELTING LAW

COUNCILMAN Morris J. Stein's proposed local law requiring de-icing of sidewalks in New York City is scheduled to come up again for hearing before the council's building committee.

REPORTS BACKLOG OF ORDERS FOR HEAVIER OIL BURNERS

AT A MEETING of the oil burner industry advisory committee sponsored by the building materials division of the National Production Authority, it was reported the industry's production had slowed at the peak of its season due to lack of steel. Although there is no shortage of domestic oil burners, a backlog of orders for the heavier types of oil burners used in schools, hospitals and factories has developed, it was said.

NPA said it was too early for a definite forecast of 1953 construction volume, but believed the final figure would be close to the 1952 estimate of $32 billion.

LABORATORY MELTS SIDEWALK SNOW ELECTRICALLY

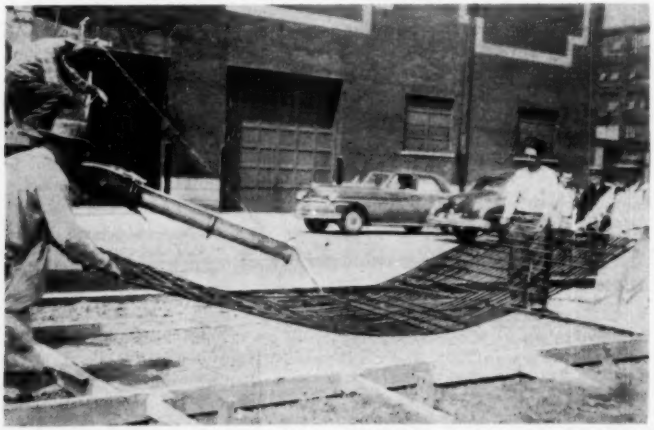
A LARGE snow melting installation using electric heating cable was recently completed at the new John T. Ryan memorial laboratory of the Mine Safety Appliances Co., Pittsburgh.

Seventy-two standard sets of 800 watts each were embedded in 1440 sq ft of concrete sidewalk along two sides of the building. With an installed capacity of 57.6 kw, a heat intensity of 40 watts per sq ft is obtained — sufficient to melt the heaviest expected snowfalls as fast as the snow comes down. The cable has an abrasion-resistant covering which will not react with free lime in concrete.

Installation was made in simple steps at the laboratory site. The standard 160 ft cable lengths were first fastened to 5 by 20 ft sections of 6 x 6 commercial mesh with hog-ring staples. Then, after an initial pouring of concrete, the mesh was laid in place and covered with another inch of concrete. Just before the concrete was smoothed the 10 ft cold leads were strung through piping and connected to junction boxes under the lawn.

Operating cost, based on an average Pittsburgh winter, is estimated at about $50 a year. This is lower than the cost of snow shoveling and ice-chopping — and more effective, too.

Other uses of such cable include soil heating in cold frames, hotbeds, and greenhouse benches; in brooders to speed chick growth; and other winter applications, such as pipe line heating, snow and ice removal from roofs, gutters, downspouts, etc.



WITH THE ELECTRIC heating cable attached, a 5 by 20 ft section of 6 by 6 commercial mesh — to which the cable sections have first been fastened — is laid in place over the initial pouring of concrete. (Photo courtesy Edwin L. Wiegand Co.)

IT CAN'T BE POSSIBLE — BUT IT IS AGAIN!

IT CAN'T BE possible but it is again — the end of another year has just about rolled around. Anyhow, best wishes to you all for a very Merry Christmas and a most Happy New Year!

AIR CONDITIONING TO EASE COURT JAM?

THE "JAM-UP" OF cases in Chicago's courts was featured in Life magazine and in the daily press last month. One suggestion to ease the backlog of cases is summer trials.

Some of the court rooms—particularly the top floor ones—are said to be practically unusable in the summer. The suggestion has been made — and it is certainly a logical one — that they be air conditioned.

500 CONSTRUCTION PROJECTS CLEARED

CONTROLLED MATERIALS for the construction of 500 commercial, religious, municipal and entertainment projects, with an estimated cost of almost $100 million, were allotted by the National Production Authority from July 1 to September 30.

In addition, 18 projects were given construction authorizations which required no accompanying allotments of materials; and 22 applicants were notified their projects did not require formal approval or allotment since the amounts of materials involved were within the limits of self-authorization.

Clyde L. Lyon School, Glenview, Illinois. Walvector in special enclosures along entire walls of windows assures comfort regardless of outside temperatures. Photo by Hedrich-Blessing.

Perkins and Will, nationally known Architects and Engineers, specify "perimeter" heating for comfort and economy . . . .

Many schools designed by this Chicago firm feature large glass areas, for beauty, better vision and more cheerful classrooms. To off-set resulting heating problems, the consulting engineers, E. R. Gritschke and Associates, have specified Webster Walvector Tru-Perimeter Heating for comfort and economy in many of the Perkins and Will schools.

Webster Walvector gently and evenly warms the exposed walls of the building. Heating-up is quick, and easily controlled. Buildings can be heated just before occupancy and the heat lowered as soon as they are empty. No blowers, fans or filters are required. Webster Walvector uses less piping than conventional radiator systems. There's no expense to conceal unsightly pipes in furred walls or trenches, no complicated run-outs.

Webster Walvector may be used in new construction or modernization with forced hot water or low pressure steam. See the Webster Representative for complete details, or write us.

Address Dept. HP-12

WARREN WEBSTER & COMPANY

Camden 5, New Jersey : : Representatives in Principal Cities

In Canada, Darling Brothers, Limited, Montreal

Webster WALVECTOR

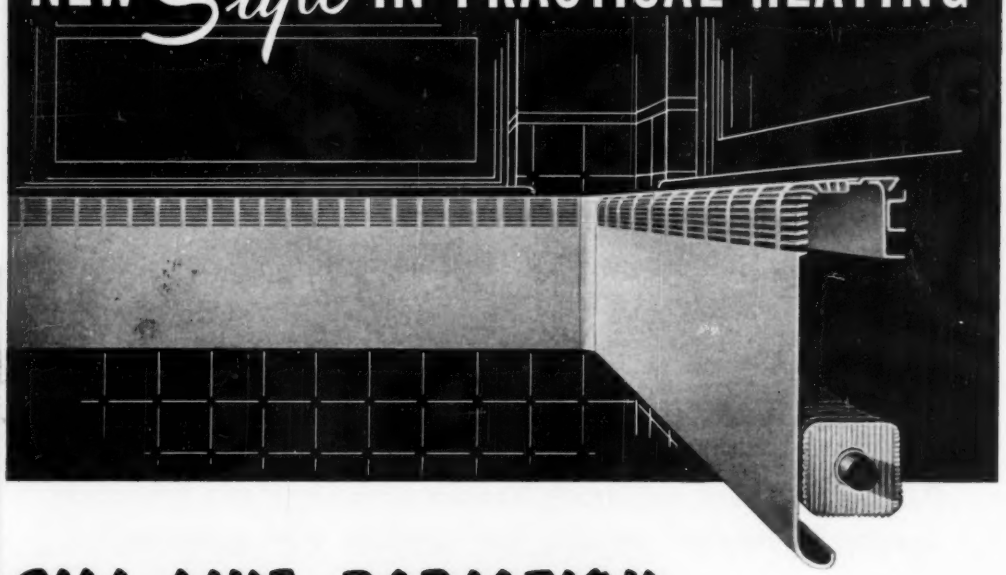
REG. U. S. PAT. OFF.

For Steam or Hot Water Heating

Left below: Teacher's lounge in Technical Building, Evanston Township High School, Evanston, Illinois. The exposed walls are heated with Webster Walvector painted to match wall color. Photo by Hedrich-Blessing.

Right: Library in Cascades Elementary School, Jackson, Michigan. Auditorium and gymnasium, in separate wings, are available for community use without opening the school proper.

NEW *Style* IN PRACTICAL HEATING



SILL-LINE RADIATION

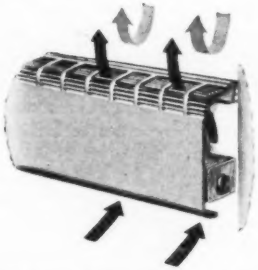
...now combines every comfort of high-capacity heating with the beauty of enclosure styling

For the first time, under-the-window wall-fin radiation is offered in an attractive rigid enclosure expressly designed for use where appearance is important. Flowing lines harmonize with modern surroundings, permit full usability of the space heated.

The new *stylized* Sill-line Radiation retains all the practical advantages of quick, uniform, perimeter heating; economy of operation; ease of installation; and flexibility. But it does more. It blends beauty with utility in full compliance with present architectural trends for hospitals, schools, apartments, office buildings, showrooms.

Go modern with Nesbitt Sill-line. Available in three enclosure sizes in nine modular lengths; two fin sizes for single row or double tierings; wide range of capacities. Investigate today.

Convected air currents enter at the casing bottom, are warmed by the heating element, and leave through the top grille. This activates warmed-air circulation from floor to ceiling and overcomes cold window downdrafts.



The warmed enclosure provides a radiant heating effect to further insure the comfort of occupants in the vicinity of the exposed walls and windows.

Send for Nesbitt Sill-line Publication 271

MADE BY JOHN J. NESBITT INCORPORATED, PHILADELPHIA 36, PENNSYLVANIA

"OPEN FOR DISCUSSION"

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to participate. Address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

"EXTREMELY INTERESTED" IN SAM LEWIS' PAGE

I WAS EXTREMELY interested, a few months ago, in reading a Sam Lewis' page published in HPAC on the theme, Am I Like My Great Grandfather? — especially since his opening phrases seem to throw some light on the source of our good friend's knowledge. I too am a great believer in the power of prayer and feel convinced that the more we keep in tune with the Infinite, the greater is the power at our disposal. Unfortunately, it seems very difficult for most of us to keep in tune, but I still feel firm in my belief that good forces surround us, ready to help if we will only make it possible. If we could peep behind the veil which separates the known from the unknown, we may learn that the spirit of Jehu Lewis is helping his descendant solve many of the problems which might otherwise cause him many perplexing moments.

I realize that my opening remarks may have taken on an entirely different phase to that intended by Mr. Lewis but, undoubtedly, he reaps a considerable amount of happiness in the knowledge that his monthly contributions assist others in overcoming their many earthly problems.

This calls to mind a card I noticed hanging on the wall of a summer cottage I visited some years ago when vacationing in Maine. The card read: "Happiness is a little flower we pluck on the *highway* to service". In these words I think we may find the elixir of happiness, for it seems the only way to obtain true happiness for ourselves is in assisting others to obtain a little of the happiness of which they may know so very little. Since we rarely know the difficulties which even our closest friends may have to encounter, the only *way* to take is the *highway* of life and remember that, whatever we may gain in seeking something for ourselves, if we could believe that our spirit in the hereafter will find work to do in helping others in their earthly struggle, we may find more happiness now by preparing our spiritual counterpart in doing things which will build up happiness everywhere, instead of concentrating on the things which tarnish with age and vanish with death.

While we may have a very firm conviction in the power of prayer and would like to have that power more often than we do, I think our failures are often due to the lack of sincerity on our part, or that we prefer to see things our way instead of the true way. However, before I give the impression that I believe everything can be obtained through prayer regardless of our own actions, and that through its power we may be able to get a shoddy piece of equipment, or a badly designed system, to operate satisfactorily, I would like to relate two true incidents which came to my attention many years ago while spending a holiday touring through Devonshire and Cornwall in England.

After attending a Sunday evening service in the local church, I learned that while the vicar had been delivering the sermon, and other members of his family were attending the same service, some intruder had entered that vicarage and ransacked the place — taking away all the money and other valuables which he could find. The irony of this was exemplified when the minister entered his bedroom and found a note left on the dressing table by the prowler saying, "You must watch as well as pray".

The other incident — which may or may not be quite as true — was also related to me in one of the rural parts of the same district, where it was customary for the landowners to give to the church a tithe, or a tenth part of their profits either in money or in kind. In many of these places the clergy meet with some of the parishioners to make a pilgrimage over the farmlands to pray for good crops. On one of these pilgrimages, the vicar stopped short on reaching one farm and after making a closer survey of the conditions which existed, turned to one of his followers and said in a low voice, "Brother John, I'm afraid in this case your land requires fertilizer more than it does our prayer".

These remarks are not made in a glib manner or intended to be sacrilegious, but are intended to indicate that, even in a matter of prayer, we should be true to ourselves and do our utmost as far as we are able to achieve what we require and rely on the power of the Infinite to help us where we fail. I am quite sure that we can obtain this help and often in a very miraculous manner, and if we do not obtain our request in the way we hope, we may then rest assured that some other purpose is intended, and that the best is yet to be.

Having gone thus far, I am now somewhat hesitant to make any comments on Mr. Lewis' article in the July HPAC. However, I am sure he will forgive me if I say anything with which he may not agree, since anything I say will be either to confirm what he has already said, or to throw some further light on the subject from another angle.

As to the lowering of the water level in the gage glass of the boiler heating a garage — which he discussed — when the intensity of the fire is increased, I think this is probably due to impurities in the boiler water. I have met several similar cases in the past and in most cases I was able to prove that the variation of the water level was entirely due to the impurities in or on the surface of the water in the boiler. In one particular job with a hand fired steam boiler, it was possible to make the water level in the gage glass vary several inches by simply opening and closing the firing door. The opening of the door simply retarded the intensity of the heat, which almost instantly allowed the water to rise in the gage glass. As the door was closed again, and the fire gave its full heat, the water in the gage glass dropped out of sight.

After placing a number of gage

glasses on the boiler to examine the results, it was found that the water banked in the boiler several inches according to the steaming rate of the boiler. By giving the boiler a very thorough cleaning and providing clean water, no such variation took place, although gradually the water in the boiler became contaminated and the same trouble was repeated. This continued for several weeks until eventually the system was thoroughly cleaned and no impurities allowed to reach the boiler — when everything continued to operate satisfactorily.

In making these investigations, I came to the conclusion that not only did impurities in the boiler water affect the operations, but the steaming area of the water in the boiler in relation to its output, the height of the water in the boiler in relation to the position of the main steam outlet, and a few other minor factors, entered into the problem. Because of these possibilities I always prefer to connect the equalizing pipe of the feedwater controller close to the top connection of the water gage, although it is much better and safer to eliminate all conditions which create such irregularities.

As regards the fact that no pressure was indicated on the gage glass, it may be that the Bourdon tube leaks or that some of the dirt from the boiler water has reached the gage and choked the small opening, thereby preventing a true reading of the pressure. I think Mr. Lewis would have done the right thing by changing the pressure gage, as he has already suggested.

Mixing Valve for Hot Water Boiler

As regards the other question concerning a mixing valve for a hot water boiler, I think it is conceded that no kind of control operating simply by outside temperature will give perfect results inside under all outside conditions. There appear to be so many factors affecting the heat losses from a building or room, that it seems impossible to achieve good results from a simple outside thermostat. However, in the majority of cases which I have investigated, I find that a blending valve, capable of modulating the temperature of the circulating water in relation to most of the prevailing outside conditions, does seem to give better results than a control which allows the temperature of the water to fluctuate widely. However, even the results obtainable from these controls depend largely on the particular type and locality of the building. It seems peculiar that in some cases a large thermal capacity of the building helps to make it easier to control; on the other hand, it is found that with some systems the thermal capacity of the building affects the control adversely. Then again, in making a decision concerning the best type of control to use, one has to consider whether it is intended to maintain an even temperature throughout the 24 hr of the day, or whether it is more desirable to operate at a lower temperature during the night and allow for a pickup in the morning. If we retard the heat input during the night for the purpose of trying to obtain greater economy in fuel consumption, or to ensure cooler rooms during the nights, then some extra heat must be added in the morning to attain the desired indoor standard.

Speaking in a general way, I prefer a control which will modulate the temperature of the circulating water as close as possible to the requirements of the building and to use an indoor thermostat to take care of any change in the conditions, which the outside thermostat is not capable of doing. It is, of course, possible to use an outside thermostat sensitive to radiant factors, wind velocity and so forth, but even when these factors are compensated for as far as possible, we invariably find that some final adjustment has to be made which can be done by an inside control. While it is not possible to do this with any great degree of accuracy with a large building, it is often found possible to secure a room which will act as a pilot room and respond fairly well as an average for the rest of the building.

In my own home I find that, in the radiant heat section, I get quite good results by maintaining a constant water temperature and using a room thermostat responsive to both radiant rays and air temperature, without the use of an outside thermostat. However, I should explain that the radiant heat section is comparatively a small proportion of the system. When using a standard room thermostat sensitive to air temperature only, the results were not satisfactory, although the same type of room thermostats on the air conditioning section prove perfectly reliable in every way.

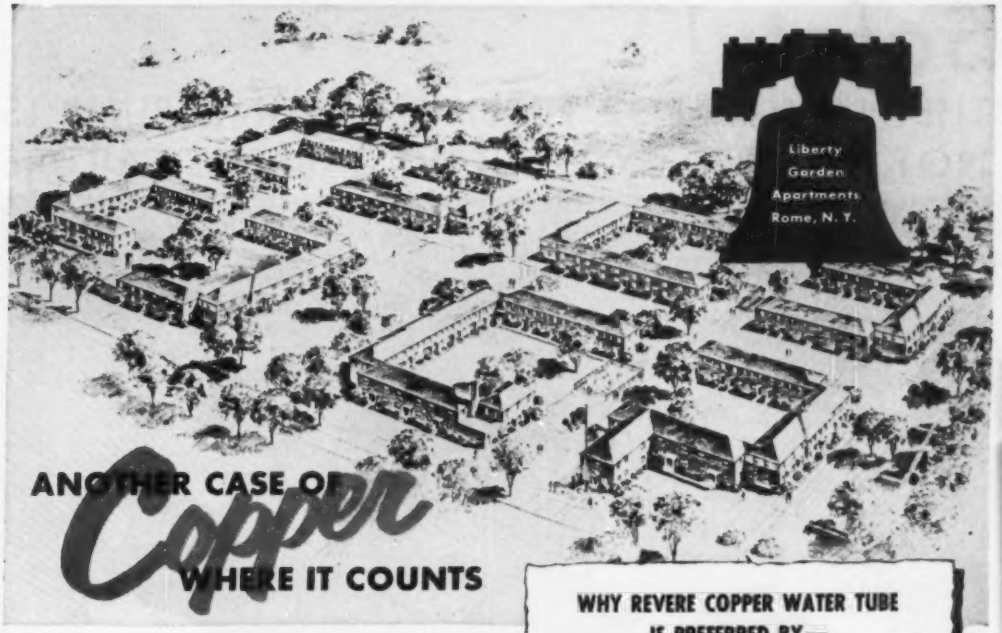
Pursuing the question of using a modulating valve with outside thermostat, much depends on the particular make of control used, and while it is well known that some modulating controls will not blend the water temperature in correct relation to the outside temperature, this fact does not disqualify the axiom that this type is the correct design to use, if correctly made. It simply means that control manufacturers should try to provide a control to give the desired results.

I find, however, that in many of the troublesome cases, the fault lies with the system and not in the control. The fault may invariably be discovered either in the design or in the inferior method of installing the work.—T. Napier Adlam, Vice President, Sarco Mfg. Corp.

[Mr. Adlam died soon after preparing these remarks. An obituary notice appears elsewhere in this issue.]

"QUOTE"

"To predict the progress in the fields of heating and air conditioning would be a dubious task. The exterior walls of our buildings may become massive heating or cooling ducts. Hot or cooled air will provide the heating requirements and afford comfort without the use of extensive pipe lines. Our structural frames will be quite different to allow for vertical ventilating shafts at many points. The excessive weights of concrete fireproofing will be reduced by the use of fire-resistant prefabricated shields, further allowing for ducts. The tremendous amortization costs of seasonably useless equipment may well be eliminated."—Walter C. Voss, Head of Department of Building Engineering and Construction, Massachusetts Institute of Technology, in a talk given at the Centennial of Engineering convention.



ANOTHER CASE OF *Copper* WHERE IT COUNTS

Architect: Kinne & Pennock—Utica, N. Y. Assoc. Architect: Robert Trowell—Rome, N. Y. Mechanical Engineer: Malcolm B. Moyer—Syracuse, N. Y. General Contractor: Peter Reiss Construction Co.—Brooklyn, N. Y. Plumbing Contractor: O'Shea Supply Co., Inc.—Rome, N. Y.

When Government regulations curtailed the use of copper water tube a while back, many plumbing and heating contractors, instead of taking a handy substitute, still knocked themselves out trying to stretch what copper they could use to cover the permitted applications where the use of copper was most vital. There must have been a reason for this. There was.

There are some spots in building construction where rustable materials have no place. Water lines is one of them. And in a 180-apartment project such as Liberty Gardens, it's mighty important that piping be non-rusting, long-lasting, easy to install. Revere filled the bill with 16,000 ft. of Revere Copper Water Tube for hot and cold water service and supply piping in sizes ranging from 4" to ½".

Now, with restrictions eased, and quantities permissible without allotments greatly increased, there isn't any reason why your next job can't have the many lasting benefits of Revere Copper Water Tube for hot and cold water lines, radiant panel heating, underground service lines, processing lines, and waste stack and vent lines. See the Revere Distributor nearest you today. And, if you have technical problems, he will put you in touch with Revere's Technical Advisory Service.

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WHY REVERE COPPER WATER TUBE IS PREFERRED BY—

Architects, Builders, Plumbing & Heating Contractors

EASY TO BEND

Saves Time

Revere Copper Water Tube is easy to bend. Soft temper can be bent by hand to meet installation conditions. Hard temper by hand bending tools.

HANDY LENGTHS

Save Fittings . . . Labor

Revere Copper Water Tube comes in straight lengths of 20' in hard and soft tempers. 60' coils of soft temper reduce the number of fittings needed.

SOLDER OR COMPRESSION FITTINGS

Need Less Work Room . . . Save Metal

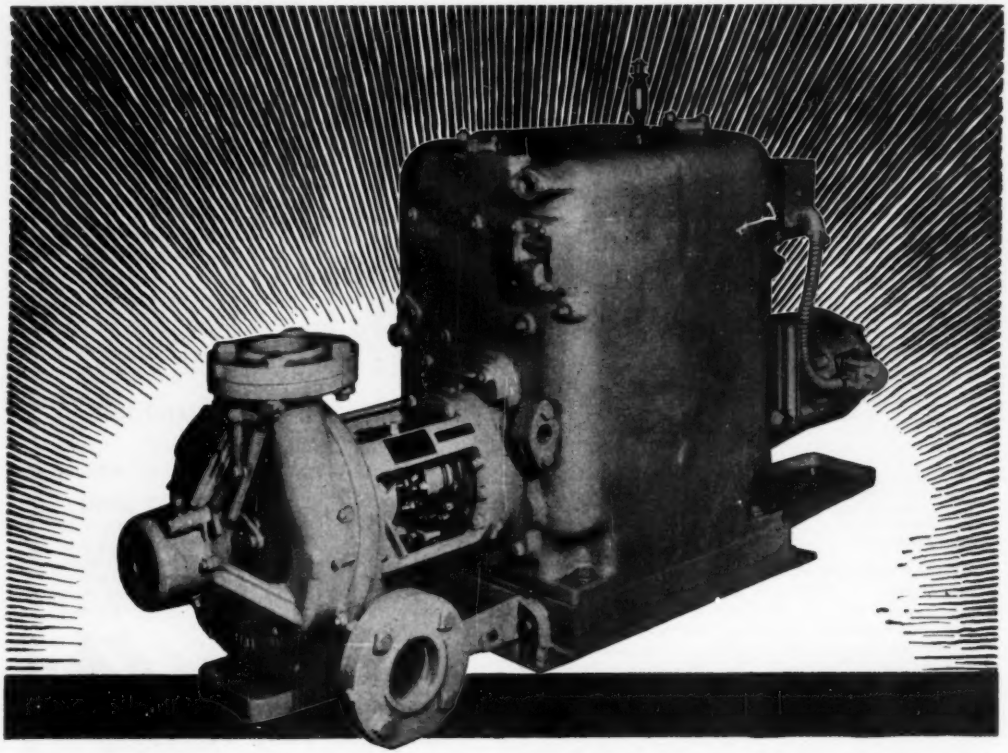
No worry about wrench room when you use Revere Copper Water Tube with solder fittings. Compression fittings can also be used. No threading is necessary with either type fitting. Wall thickness of tube used can thus be less than for threaded pipe.

NON-RUSTING

Rustable pipe eventually clogs as shown in drawing at top right. Non-rustable Revere Copper Water Tube suffers no loss of flow or pressure as shown at bottom right. No allowance in pipe size need be made for rust accumulation with Revere Copper Water Tube.

Safety!

THE NASH VAPOR TURBINE HEATING PUMP IS NOT STOPPED BY ELECTRIC CURRENT FAILURE



For service in greenhouses, hospitals, schools, theatres, and public buildings, where heat failure is a serious matter, the Nash Vapor Turbine Return Line Vacuum Heating pump should be specified, for this pump operates perfectly without electric current.

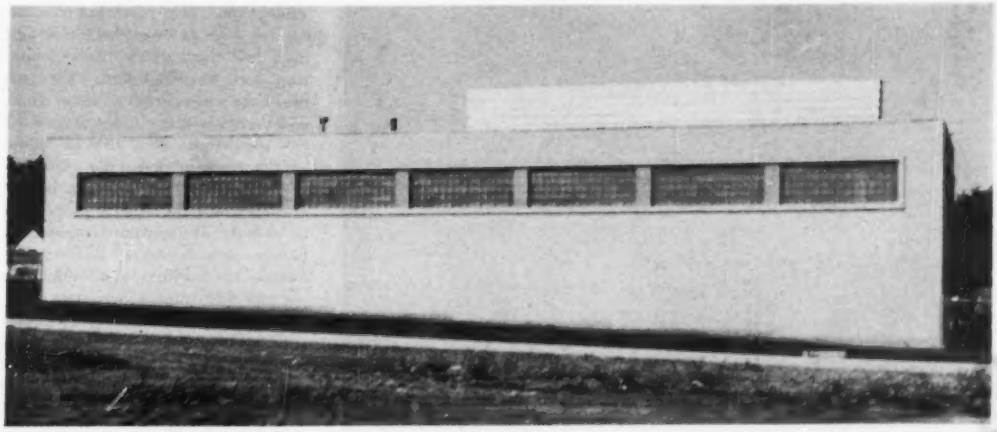
This is because the motive power is a special turbine operating on steam direct from the heating system. Steam used to drive the Vapor Turbine is returned to the system for heating, with little heat loss.

This pump insures constant heat in the system, it eliminates electric current cost, and it promotes high efficiency in the heating system. Heating efficiency is due to the fact that this pump can operate continuously with economy. Continuous operation means uniform circulation, and uniform conditions in the system mean steam saving.

This pump has but one moving part, no internal wearing parts, and requires no internal lubrication. Bulletin D-246 tells all about it, and it is free on request.

THE NASH ENGINEERING COMPANY

SOUTH NORWALK, CONNECTICUT, U. S. A.



THE BOILER HOUSE is 1300 ft from the terminal building and out of the normal flight pattern. Induced draft fans eliminate a tall chimney

Heating Airport Terminal Building

. . . . for the new Greater Pittsburgh airport. Features of the design and the reasons for them are explained

By Theo. F. Rockwell
Consulting Mechanical Engineer

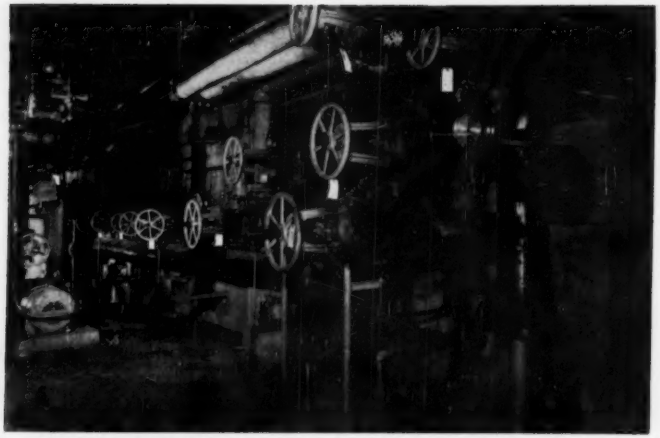
TERMINAL BUILDINGS at airports serve the primary function of facilitating the transfer of passengers, mail and cargo to and from airplanes. If the airport is near a large industrial city where traffic is heavy, it becomes necessary for the terminal building to serve a number of secondary functions which arise out of the dense traffic — such as catering to the comfort of passengers; providing space to handle baggage; providing quarters for ground crews and maintenance departments; and for airlines communication and traffic control. At the new Greater Pittsburgh airport there are also restaurants of various types for passengers, crews and airport employees; a hotel for passengers; and dormitories for flight personnel.

The air transports used by commercial airlines are quite large and require a great deal of ramp space for docking. In 1945, when the preliminary plans were started for the terminal building, the designers decided to allow a circle 150 ft in diameter for each plane gate and to provide for an ultimate capacity of 30 gates. This, then, required a ramp 4500 ft long — somehow conveniently located to a building that, in turn, must be of a reasonable size.

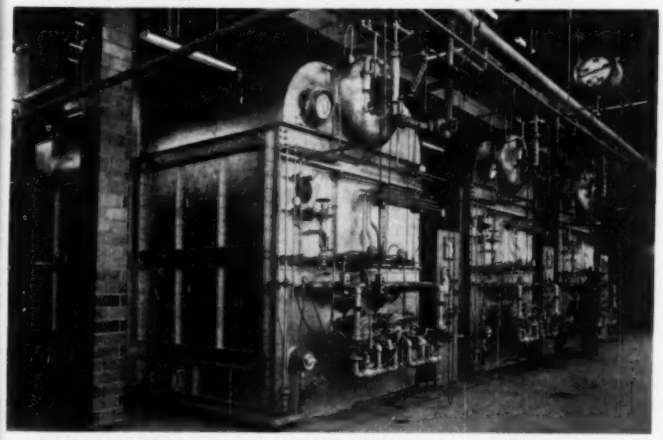
The late Colonel Theodore Eichholz was the architect primarily responsible for the fundamental design of the Greater Pittsburgh terminal building. The preparation of the final working drawings was carried out by a staff of architectural and engineering consultants working under the direction of John B. Sweeney and Edward G. Messner, Director and Chief Engineer, respectively, of the Department of Aviation of the County of Allegheny.

To accomplish his principal aim of making it easy for a passenger to transfer from an airport bus to a plane, or vice versa, Colonel Eichholz conceived a building with a semi-circular central core and with three radiating fingers or docks spaced 90 deg apart — each dock having space for 10 planes.

In the first phase of development, the central core and the south dock (the main entrance to the terminal building faces north) were constructed. Before this much of the program was completed, it became apparent that 10 gates would be



PRESSURE REDUCING station supplies 35 psi steam to the terminal building. This photo was taken before insulation was completed



THREE BOILERS are installed, with room for a fourth. Each has two dual fuel burners. Gas is the primary fuel, with oil the standby

FEEDWATER HEATER on the mezzanine floor of the boiler house

inadequate. Therefore, ramp facilities for three gates of the future east dock and three gates of the future west dock were installed. The port has been in operation since June, and there are many times during the day when there are 10 to 12 planes on the ramp at one time.

A feature of the building is that much of its field floor is given over to a maze of internal driveways to handle the vehicular traffic incidental to loading and unloading planes. Providing a periphery large enough to dock 30 planes, together with an internal driveway system, tends to create a large building, but the design has led to a big reduction in vehicular traffic on the apron.

Wherever large numbers of people congregate, a business opportunity exists for such concerns as drug stores, gift and novelty shops, restaurants of various types, dairy bars, display advertisers, amusements, etc. Thus, another important function of a terminal building is to provide some rentable area which can be leased, thus helping to finance the basic project.

The design of the mechanical equipment for the terminal building has been a very interesting experience, largely because of the wide variety of occupancy conditions which occur within the walls of a single structure. More will be said about this later.

As is usual in projects of this type, the scope of the project has been revised several times since the work began in 1945. Active participation by the consultants began in 1947 and late that year ideas had crystallized sufficiently that it could be agreed that steam would be needed for space heating in the terminal building and a possible service building, for heating hot water, and for cooking and other kitchen use. The possibility of a laundry at the airport is unsettled at this time, but boiler capacity is available if required for this purpose.

Why a Separate Boiler House Was Built

When the steam loads were forecast and the size of boilers and auxiliaries was determined, the original plans to put the boiler room in the building were abandoned and plans for a separate boiler house were

started. Factors which favored the remote boiler house were:

1) Elimination of rock excavation for boiler room.
2) Removal of chimney from building.
3) Elimination of fog (from water vapor in combustion products) in vicinity of control tower.
4) Easier and better ventilation of boiler room.

The boiler house is 1300 ft from the terminal building and is almost due north. Thus, it is out of the normal flight pattern of planes landing or taking off. The boiler house was designed "from the inside out" by the architect to fit the boilers and auxiliaries selected.

High pressure lines for the transmission of natural gas were already in place on the airport property. Gas was selected as the primary fuel because of its availability and its economic advantages. During the past few years, however, gas has been subjected to a variety of regulations which can lead to interruption of service. Continuity of service is of prime importance at an airport, so equipment to burn oil was installed for emergency and standby. Four 25,000 gal storage tanks provide enough fuel for 30 days' operation at peak weather conditions.

Three longitudinal drum, vertical water tube steam generators were installed under the original contract and there is room in the boiler house for a fourth when conditions require it. Each boiler is fitted with two horizontal firing, dual fuel burners. The oil burners are the mechanical atomizing type, and the gas burners are the induced draft type. Primary and secondary combustion air is admitted through air registers which permit manual resetting as required by fuel changes. The normal rating of each generator is 10,900 lb per hr, but burner capacity is adequate to boost output to 18,000 lb per hr for short periods.

Induced Draft Fans Eliminate Tall Chimney

Tall chimneys are undesirable in the vicinity of airports because of possible interference with the glide angle of planes approaching for a landing. The chimney was eliminated by using induced draft fans, one for each boiler. The fans discharge through stub stacks which terminate 10 ft above the room. The stacks are concealed by an ornamental band of corrugated aluminum.

How Steam Generation Is Controlled

Pneumatically operated controls are used to vary the output of the steam generators in proportion to demand. A master pressure controller mounted on the main steam header maintains a constant header pressure of 125 psi (plus or minus 3 psi) by adjusting the throttling dampers in the discharge of the induced draft fans. Each fan has its own damper motor. A secondary controller measures the change in draft loss between the combustion chamber and the smoke outlet, and then throttles the fuel supply to maintain the optimum fuel-air ratio.

The burners have a safe turndown ratio of 3.5 to 1, and each burner is independent of the other burner in the boiler. Thus, a boiler can be operated down to about 1/7 of its maximum output by closing the manual fuel valves for one burner. If load conditions should require operation below the safe minimum fuel input, safety controls will shut down the burners completely, after which manual starting is required to get the burners into operation again.

The control system also provides for operation of the draft fan for 90 sec before fuel valves open to purge the combustion chamber of combustible gases. There is also a further delay after the pilot light has been ignited before the main fuel valves open.

The boiler control panel contains recorders which measure the CO_2 content of the flue gas, the stack gas temperature, and the draft in the combustion chamber and the boiler outlet. There is also manual control which permits the operator to change the fuel-air ratio if his instruments show that he is not getting the proper CO_2 or stack temperature.

The change from one fuel to another requires some manual operations. A burner ring is used for gas, and a nozzle is used for oil. One has to be removed and the other installed when a change in fuels is made. Manual fuel valves are opened or closed as required. The transfer requires about 20 minutes per boiler. A fuel selector switch mounted on the control panel prevents the simultaneous opening of the automatic gas and oil valves.

The Steam and Condensate Piping

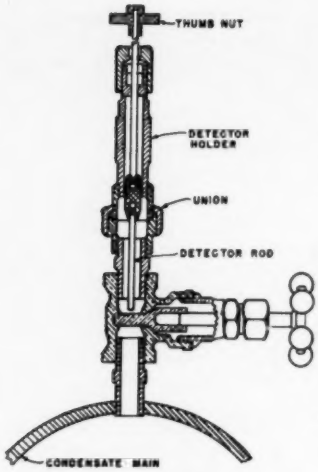
The boiler house and the terminal building are connected by underground steam and condensate return lines, each in its own welded steel conduit. Packless type expansion joints in steam lines in brick manholes are located at intervals of approximately 250 ft. Bends in the manholes handle the expansion of the return piping. All the steam and condensate piping is welded.

The boiler control system maintains a steam header pressure of 125 psi. The loss of pressure between the boilers and the terminal building varies from 3 to 7 psi, depending on load. A pressure reducing station reduces the pressure to 35 psi, at which steam is distributed throughout the building. The 35 psi was selected to meet the requirements of the kitchen equipment; other equipment which is automatically controlled — such as heating coils, water heaters and converters — operate at a pressure of 15 psi at full load, there being a pressure drop through the control valves of 15 to 20 psi.

Condensate Is Recovered

The condensate from all steam equipment is recovered, except for a small amount used in kitchen and bakery equipment which does not provide for the return of condensate. All condensate is returned to a large accumulator in the basement machinery room. The service hot water is preheated by passing it through a heat exchanger located in the vent from the accumulator. Loss of vapor through the tank vent is thus reduced. The condensate is returned to the boiler house surge tank by a float controlled duplex pump.

Another condensate pump in the boiler house pumps the condensate from the surge tank to the deaerating feedwater heater on the mezzanine floor of the boiler house. Any make-up water required is admitted to the feedwater heater through a float controlled valve which is part of the



CORROSION DETECTORS were installed in the return lines. Detector rod of known weight may be removed and weighed to indicate corrosion rate

heater. The feedwater is brought to a temperature of 200 F by exhaust steam from the turbine driven boiler feed pumps. If this steam supply is inadequate, or if the motor driven pump is being used, then steam is admitted from the header through an automatic valve.

Raw water fed to the boiler to make up losses resulting from blowdown, excess exhaust steam from the turbine, flash steam and leaks seldom exceeds 10 percent of the total feedwater, and all of the feedwater, as mentioned above, is deareated before it enters the boiler.

Treating Water and Preventing Corrosion

The municipal water supply for the airport is of good quality. However, tests were conducted by a firm of water chemists during the period of temporary operation by the contractor, and as a result of the firm's recommendation, additional treatment equipment was installed.

A chemical feed pump was provided for each boiler. These pumps are used to introduce a treatment compound consisting of an organic colloid to control sludge, phosphate to control hardness, sulphite to control pitting, and an alkali to control the pH of the boiler water. Over-concentration and sludge are controlled by intermittent blowdown.

A separate chemical feed pump is used to introduce a filming amine into the feedwater for the purpose of coating the inside of the return piping to inhibit internal corrosion.

Corrosion detectors have been installed in several places in the return lines to give indications of the rate of corrosion. The type of detector used is shown in the sketch. The detector rod is iron of known weight. It is assembled into the holder, and the holder is then attached to the condensate main by the union. The gate valve is then opened and the detector rod is inserted into the condensate by turning the thumb screw. After a definite period of time, the detector rod is removed and weighed. The loss of weight is an indication of the corrosion rate in the pipe.

A steam flow meter, a meter in the make-up water line, and fuel oil meters provide data for cost accounting purposes. Information on gas consumption is available from the monthly bills.

Wayne Crouse, Inc., was the mechanical contractor for the boiler house.

[A second article will describe other of the terminal building's heating and air conditioning.]

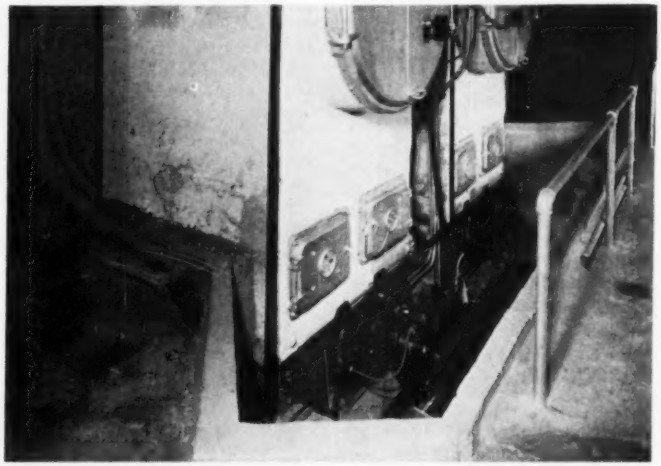
UNUSUAL FIREBOXES FOR OIL BURNER JOBS

SEVERAL CASES WHERE out-of-the-ordinary methods were required to make satisfactory oil burner installations were described in an article by Kalman Steiner, of C. Hoffberger Co., published in the June HPAC. Since appearance of the article, a photo showing one of the installations he discussed has become available and is reproduced here.

Building columns on each end of this battery of two apartment house heating boilers rest on footings that also serve as support for the boiler bases. The shallow bases, adequate for hand firing, were inadequate for oil firing. Structural design prevented pitting straight down through the column footings, as would have been done under ordinary settings.

The burner center lines were moved inward — that is, to the right for the left-hand burner, and to the left for the right-hand burner. The center lines then were given a slight inclination toward the opposite side, shooting the flame diagonally across the boilers.

Insulation between the refractory and the footings protects the concrete from heat. Plastic refractory served to permit construction of the odd shaped combustion chambers with sloping walls to conform to the contour after the edges of the footings were chamfered off.



OFF-CENTER FIRING is used on this installation, structural design preventing pitting straight down through the column footings as would have been done under ordinary settings

Maintenance costs are reduced by keeping dust out of machinery

How To Lay Out Piping for Industrial Vacuum Cleaning

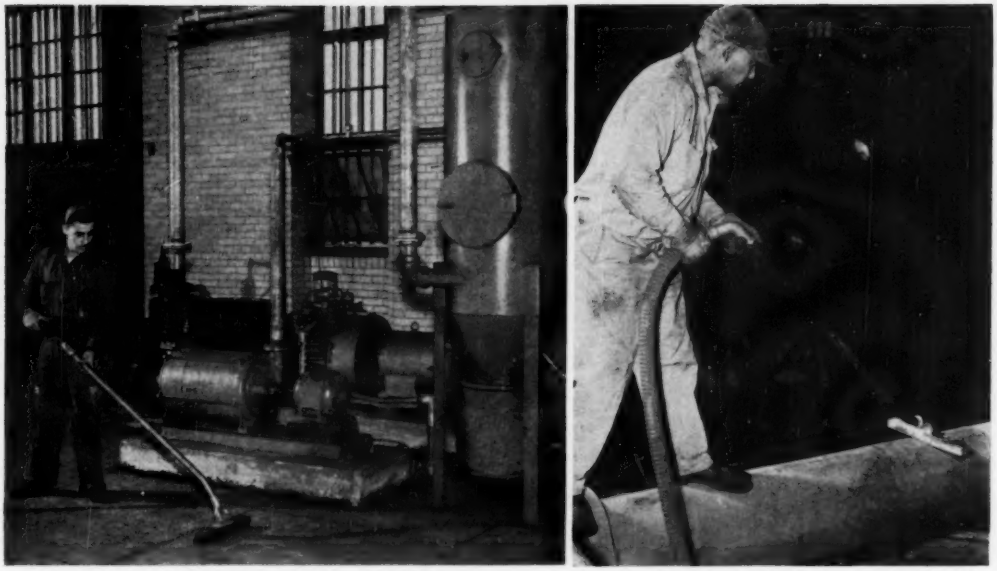
By Angus M. Brown
Manager of Blower Sales
Lamson Corp.

Among the many uses of central vacuum cleaning systems in industrial plants are salvaging spilled raw materials, improving working conditions through cleanliness of working areas, eliminating fire and explosion hazards, lengthening machinery and equipment life, etc. A centralized system provides for the attachment of cleaning tools in any convenient location, allows for the right cleaning tool for the particular job

TO INSURE EFFICIENT and economic factory maintenance with an industrial vacuum cleaning system, the piping should be laid out to (1) provide inlet valves near areas where vacuum cleaning will result in the greatest savings, (2) reduce operating costs by locating the exhauster and the separator so that the pipe runs will be as short and straight as possible, and (3) minimize friction loss in the piping by using pipes of large enough diameter but small enough to allow rapid movement of air and dust.

The first step in laying out the piping is to survey the plant to decide what areas are to be covered by sweepers and where to locate the inlet valves. Some of the most important functions of central vacuum cleaning systems are to salvage valuable dust from walls, floors or fixtures; to prolong the life and reduce maintenance costs by keeping dust from operating machinery; to prevent spoilage caused by dust on parts during accurate machining operations; and to eliminate explosion and health hazards. Vacuum cleaners anywhere in the plant can improve working conditions and plant housekeeping.

After determining the areas to be vacuum cleaned, inlet valve points 12 in. above the floor are selected and so spaced that these areas can be covered by hose no more than 50 ft long — taking into consideration the machines and other encumbrances the operator must work around. It is advisable to keep hose to the 50 ft maximum because friction loss is



WORKING CONDITIONS and plant housekeeping are improved by vacuum cleaning

less in piping than in hose. If the hose must be longer than 50 ft, the increased friction loss can be counteracted by increasing the exhauster output.

The choice of the location of the exhauster and separator will, of course, be influenced by the availability of plant space and the convenience in removing dust from the separator. Exhausters and separators are designed to conserve plant space.

Example Shows How To Size Piping

The next step is to make a rough layout of the proposed piping, paying no attention to pipe sizes (see Fig. 1). The layout should show inlet valves, piping turns and the length of straight runs of pipe.

In making the layout, it is not good policy to bring several sweeper lines into a single header covering any great distance. If a section of the system is engineered for many sweepers, when only one is being used the velocity will drop as air enters the large header — thereby causing material to settle or separate.

To determine the diameter of the pipes, a vacuum cleaner pipe size chart such as that shown in Fig. 2 may be used. To use the chart:

1) Determine the total effective length of the piping from the discharge end of the exhaust pipe to the most remote inlet valve on each line. The total effective length is the actual length plus 10 ft for each 90 deg turn.

2) To obtain the pipe size at any point in the system, determine the maximum number of sweepers to be served simultaneously through the pipe at this point. On the right-hand side of Fig. 2, choose the curve marked with the number of sweepers. Follow the curve to the left until it intersects the vertical line representing the total effective length of the line to obtain the pipe size. Use the nearest pipe size indicated.

TABLE 1—DETERMINING PIPE SIZES for typical vacuum cleaner system sketched in Fig. 1

Pipe junctions	Number of sweepers being served simultaneously	Length of pipe in longest line served, ft	Number of 90 deg turns	Number of turns times 10	Total length of longest line served, ft	Required pipe size, in.
A to *B*	10	390	12	120	510	6
B to *C*	4	370	12	120	490	4
C to *D*	3	370	12	120	490	4
D to *E*	2	370	12	120	490	3
B to *J*	6	390	12	120	510	5
J to *K*	5	390	12	120	510	5
K to *L*	4	390	12	120	510	4
L to *M*	2	390	12	120	510	3
L to *R*	2	260	12	120	380	3*

*Use 4 in. pipe from *L* to *R* because it is a riser. Use a 2½ in. pipe from *R* to *S*. From *C* to *F*, *D* to *G*, *E* to *H*, *E* to *I*, *J* to *N*, *K* to *O*, *M* to *P*, and *M* to *Q* use 2 in. pipe.

To illustrate the method of determining pipe sizes, the diameters of the piping for the example of Fig. 1 are worked out in Table 1. Start with the pipe from valves *A* to *B*, which serves 10 sweepers simultaneously. The actual length of the longest line served is 390 ft, obtained by adding pipe lengths from *A* to *Q* (as shown in Fig. 1). The number of 90 deg turns between *A* and *B* (12) is multiplied by 10 and entered in the fifth column of the table. This is added to the actual length of the longest line, giving a total effective length of 510.

Now, on Fig. 2, we follow the curve marked 10 sweepers to the vertical dotted line through the 510 ft total effective pipe length. We then follow the horizontal dotted line to get 6 in. as the diameter of the pipe from *A* to *B*.

The rest of the values in the table are obtained in the same way.

Line risers need not be as small as figuring them by the above outline would indicate, because material in a riser will fall by gravity and high air velocity is not needed to carry it along. The line risers should be one size larger than figured. In drops, gravity is working against the movement of the dusty air, so smaller pipe diameters are required. Drops to 1½ in. valves should be 2 in. in diameter; drops to 2 in. valves should be 2½ in. in diameter.

As is indicated on the pipe size chart, the pipe diameters given are for 1½ in. sweepers. To find the pipe sizes for 2 in. sweepers, the number of sweepers is multiplied by 1.8 and the same diagram is used. The conversion factor is 1.8 because a 2 in. hose handles 80 percent more air than a 1½ in. hose.

Fig. 3 shows piping details for a typical vacuum cleaning system. Standard black pipe and long turn drainage fittings without pitch are used. Both 2 in. and 1½ in. inlet valves should have 2 in. IPS male threads for interchangeability.

To reduce friction loss in piping, all pipe ends should be reamed. Drops should be taken from the side of the main except at the end of the line. Various types of piping turns are shown at the bottom of Fig. 3. For connecting the riser with the main horizontal line, bends of radius equal to 10 times the diameter of the pipe should be used if space permits. Pipe should be bent for all offsets.

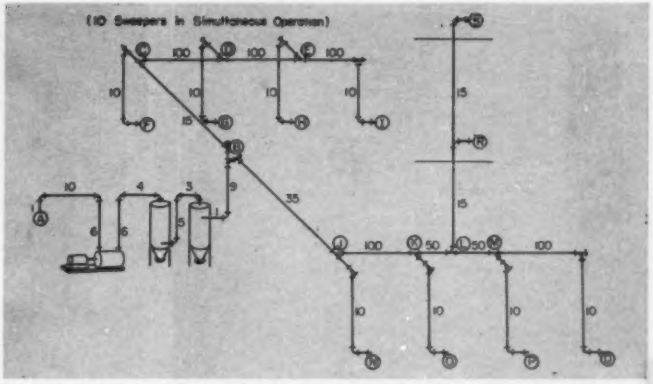


FIG. 1 — ROUGH LAYOUT of proposed industrial vacuum cleaner piping

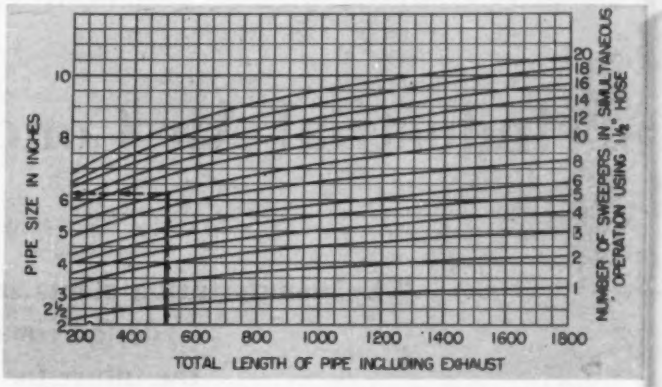


FIG. 2 — PIPE DIAMETERS are determined by means of this vacuum cleaner pipe size chart

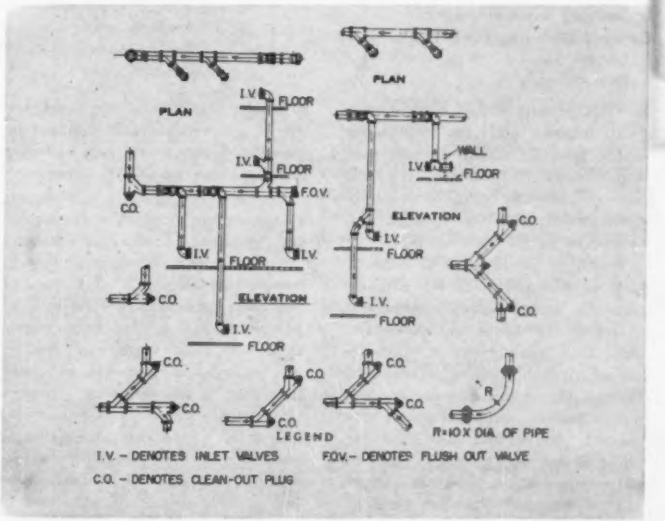
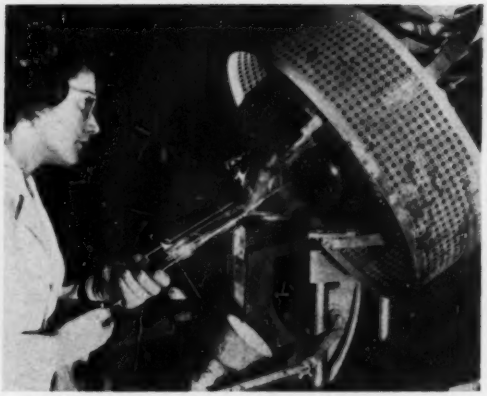


FIG. 3 — PIPING DETAILS for typical industrial vacuum cleaning system

LOW FLOOR AREA PER WORKER justifies plant air conditioning on an improved efficiency basis



HYGROSCOPIC NATURE of the inside coating of a kinescope tube makes air conditioning a "must"

Industrial Air Conditioning

Why manufacturing plants are conditioned, what the design considerations are, and how the future for such applications looks

By S. M. Miner
Industrial Sales Manager,
Central District, York Corp.

IN VIEW OF THE widely diverse technical reasons and the importance of the general reasons for air conditioning, any economic justification will have to be on the basis of assumptions and calculations arranged to fit the specific case.

Economic justification is unnecessary in certain instances. The decision to utilize sealed construction (blackout type plant, windowless factory, etc.) usually pre-supposes the use of air conditioning. The manufacture of certain hygroscopic materials will pre-suppose atmospheric control. In certain cases, the machine design and quality control departments will establish manufacturing conditions which they will not consider without the use of air conditioning. In all of these cases, the use of air conditioning will not be questioned any more than a winter heating plant would be questioned.

Nearly every industry experiences a summertime decline in production per man-hour. Production increases can result from summer air conditioning — particularly because of less absenteeism, fewer rejects of precision parts spoiled by perspiration, minimum errors in reading and calculating and not so many time-outs at the drinking fountain. Obviously, economic justification for industrial plant air conditioning must usually be based on circumstantial statistics. Furthermore, the initial costs are frequently tied in so closely with the overall plant costs that they are difficult to segregate. In most cases, a sensible approach is to seek out a similar plant, and find out what the user's experiences, costs and advantages have been.

Justifying Conditioning on Economic Basis

Attempts to justify an air conditioning installation on an economic basis will usually fall into one of three types:

1) Analysis of the value of savings due to reduction of rejects, spoilage or reprocessing of parts.

2) A unit cost analysis directed toward the development of a cost per worker or per dollar of payroll or per unit of production, and possibly compared with an anticipated increase in efficiency.

INSPECTION REJECT RATES can almost be plotted against weather data unless air conditioning is used

FINELY FINISHED SURFACES must be protected. Air conditioning is a 24 hr a day requirement

3) Simple comparison with generalized statements from manufacturer's experience along similar lines.

A brief discussion and examples of each of these follows:

The production control engineers of a large manufacturer contended that their anticipated reject rate would run approximately 4 percent and that it could be reduced approximately 1 percent by the installation of air conditioning. On the basis of producing 1000 units per day and a reject correction cost of $10 per unit, this gave a net saving of $100 per day. Obviously, this would not prevail throughout the year, so they based their calculations on 150 days per year. The condensed analysis, based on an air conditioning system costing $50,000, is:

Depreciation	$5000
Operating costs	1200
Maintenance and repairs	1500
Interest on investment	1250
Insurance and taxes	1000
Total annual cost to own and operate	$9950

Estimated annual production cost savings = $100 per day × 150 days = $15,000.

Net annual cost saving due to air conditioning = $5050.

A large manufacturing plant producing a very small high precision machine part in an air conditioned atmosphere had a reject rate in one department of approximately ½ of 1 percent. Due to a major breakdown, the plant was operated during the summer for a period of four weeks without air conditioning, and the reject rate climbed to 1½ percent. On return to normal operations, the rate dropped to its original ½ of 1 percent. In another department in the same plant, and during this same period of time, the rejects increased from 1 to 2½ percent during the shutdown period. With the knowledge that the production rate was approximately one million units per month, a calculation similar to the one above could be made.

It has been pointed out by many authorities that the annual charge for the plant building is relatively small compared with the annual cost of wages. Hence, any reasonable expenditure that will cause an increase in the efficiency of labor will result in an overall benefit to the business. An article on economic justification for new plant construction in Mill & Factory magazine stated that "it is reasonable to assume that the annual charges for interest, amortization and real estate taxes on a manufacturing plant itself, without the manufacturing equipment, amounts to only about 1/10 or less of the annual cost of labor." Consequently, in any contemplated plant revisions, it is unwise to cut corners and effect minor savings in construction which may have an adverse effect on the total plant production.

A thorough analysis of the air conditioning installation costs at a typical plant in Indianapolis produced a cost of operation for the first year of $311,576. This included 24 percent for depreciation, 28 percent for steam, 30 percent for electric power for fans and compressors, and 13 percent for labor. Breaking this down on a unit basis, this represented $0.30 per sq ft per year or $0.013 per employee per operating hour.

From another installation, it was found that the entire first cost of the air conditioning system could be written off in two years and even then, when added to the operating and maintenance cost, would only add approximately $0.025 each to a unit cost in excess of $20.

An efficient machine shop has a yearly production valued at $103,750. Based on a 5 percent production increase during the winter and 10 percent increase during the summer due to year 'round air conditioning, there will be a total annual increase of approximately $7800. Based on a 10 percent profit margin there would be a $780 per year increase in profit directly attributable to air conditioning. This can be compared with the depreciation and operating cost of an air conditioning installation.

All of these examples can be utilized for comparison with other plants. Statements of almost an infinite variety can be found in various journals regarding experience of an economic nature due to the installation of air conditioning. Following are a few such statements.

A cigar factory reported as a result of air conditioning that summer absence from illness was reduced from 50 girls per day to 5 girls per day. Labor turnover was reduced by 100. Rejects were reduced from 4 to between 0.5 and 1 percent. Production increased 10 percent.

The findings of a utility company as to efficiency of operations in a drafting room and surveying bureau office have been quoted many times. During the summer of 1937, in offices without air conditioning, 8988 new work units required 5008 man-

hours. During the summer of 1938 in the new air conditioned building, 10,477 work units required only 3872 man-hours — an increase in efficiency of 51.4 percent.

A wax plant reported the cost of operating the air conditioning system at about $0.10 per day per employee for 250 employees. The air conditioning installation in their large office (basically not much different from light manufacturing work) showed employees producing from 15 to 25 percent more work. All department heads agreed that: (1) machine operating errors had been reduced, (2) absenteeism had been lessened, (3) hot weather fatigue had become negligible, (4) daily production of work was nearly constant regardless of outside conditions, (5) employees put in a more nearly 100 percent working day.

A knitting mill reported in 1947 that air conditioning had produced an average increase of 5 percent in worker productivity.

Design Data for Plant Air Conditioning

Fundamentally, an air conditioning system for a manufacturing plant is no different from any other air conditioning system. Hence, the survey data required is basically no different. Any form of standard survey analysis sheet can be used. Due to the extremely varied nature of manufacturing applications, much of the data on a standard survey sheet will not be applicable, and there will be other items which the air conditioning engineer should note and take into consideration.

During the preliminary design of a manufacturing plant installation — as in all air conditioning installations of any size — notice should be taken of the necessity for special zoning. In extremely large plants, zoning control is automatically brought about by the practical limitations on the size of even field-assembled air conditioners. Air conditioners handling in excess of 40,000 to 60,000 cfm are cumbersome and inflexible. Hence, large installations will automatically zone themselves into areas by the size of the maximum air conditioner to be utilized.

Closely allied to zoning is the concept of designing for the general building as opposed to designing for the specific plant operations. The objective is a plant having maximum flexibility and requiring the minimum alterations to meet plant or process revisions. If possible the air conditioning system should be a part of the property — just the same as the heating plant — instead of a system matched to the manufacturing operations. This is not possible in every instance, but where it can be done, it will enhance the value of the air conditioning system.

In designing the plant and its air conditioning system, possible future variations in use and changes in ownership should be kept in mind. Many factories — such as those built during the war — have been taken over by other manufacturing concerns and re-adapted to different manufacturing operations.

The Austin Co. has supplemented the features of the "controlled conditions" plant with what is termed an "integrated unit — area system" for air conditioning spaces having floor areas of 8500 to 20,000 sq ft. This combines the features of zoning and design for the general building. It is a pre-designed system arranged to be installed in the roof trusses, in multiple duplicate units or stations. These are first assembled on specially designed platforms which are then hoisted into position above the bottom chord of the trusses. They may be complete direct expansion systems or chilled water air conditioner stations.

In most manufacturing plants, the internal load from heat producing equipment will represent a far greater percentage of the total load than it does in other air conditioning applications. Heat leakage often will be relatively insignificant. Hence, a careful analysis of internal heat generating equipment, time of usage, load factors, etc., will be required. Of particular importance are electric motor loads. Full motor load at 100 percent load factor will be involved in such cases as motors for conveyors and most supply fans. At other times, it may be possible to apply definite load factors where it is known that certain motors will not be operated at the same time as others or will be operated intermittently — many machine tools, crane motors and compressor motors are examples. Exhaust fan motors, when located in the air conditioned space, add to the internal load only to the extent of the motor losses.

Important to Reduce Heat Loads

Heat generated by gas burning and other specialty devices such as heat treating ovens, electroplating devices, degreasers, etc., can be an appreciable portion of the load.

An article on reducing heat loads in industrial air conditioning, by L. R. St. Onge, brought out some of the problems involved and the advantages of exhaust hooding of concentrated heat loads. Since the exhausted air must be replaced with outside air, no saving in total required cooling capacity will be effected unless its heat content is equal to or greater than that of the outside air. With outside air at 95 F dry bulb and 78 F wet bulb, and inside conditions of 78 F dry bulb and 45 percent relative humidity, the exhaust hood design must be such that the temperature of the exhaust air exceeds approximately 122 F dry bulb. Hood efficiency figures available are very meagre. A range of 50 to 85 percent is easily possible; 60 to 70 percent seems to be practical with well designed hoods.

The second method of reducing internal loads is by proper insulation when this is economically worth while. The reduction in internal heat load by either means can make an appreciable saving in the amount of air which must be circulated to absorb the load.

Generally, the degree of internal people loading in a manufacturing plant may be taken as follows:

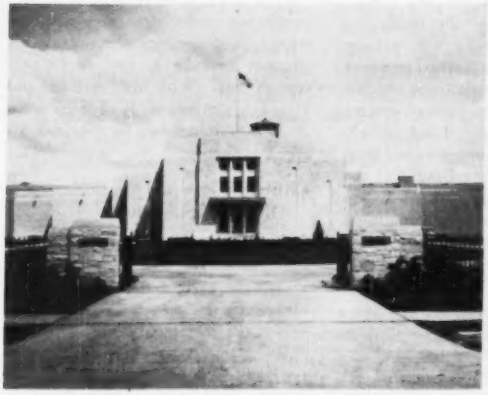
80 to 120 sq ft per person — heavily populated

200 or more sq ft per person — lightly populated

In calculating the heat generated by the workers in a production area, some consideration must be given to the degree of activity. With wide variations in heat gain due to the rate of work and the design conditions, judgment must be used in the application of these factors.

As to the heat gain from various types of apparatus, generally, data must be secured from the apparatus manufacturer or the user. The usual instance will involve a determination of the amount of gas, steam or electric input to the apparatus and then a conversion of that amount to equivalent heat units. Due regard should be given to the ratio of sensible to latent heat and to the efficiency of hooding and exhaust.

As has been previously pointed out, there may not be as large a market for air conditioning of manufacturing spaces in existing buildings as for new buildings. Actually, since the building heat leakage usually



WINDOWLESS CONSTRUCTION has advantages in ease of air conditioning, steadier cooling load, etc.

PRECISION PRODUCTION of highly finished parts requires air conditioning and careful handling

represents no major portion of the heat load, the fact that an old building is utilized should not be a deciding factor. The usual considerations as to advisability of roof insulation, shading of windows or use of venetian blinds will apply.

Special consideration of the construction of existing buildings will be required when low or high relative humidities are to be maintained. Under these conditions, the application of air conditioning to old buildings may become difficult. Standard methods of moisture leakage calculations should be followed and the possibilities of insulating against this leakage should be investigated.

Albert Kahn Associates, Architects and Engineers, have recommended use of an air lock, particularly where vapor pressure differences due to low relative humidities are involved. For a high relative humidity condition, difficulty will be experienced in winter operation.

Where new buildings are to be air conditioned, special building construction will usually be considered by the architect and consulting engineer.

Value of Insulation, Double Glazing

Opinions vary on the relative value of insulation but an increasing number of plants find insulation economically justified. Many manufacturing plants that were built with well insulated structures, found that heating was not necessary until outside temperatures dropped to as low as 10 F. This indicates that insulation should be definitely considered, particularly in roofs and possibly in wall structures.

In an installation in Massachusetts, special building construction features have been very successful. The exterior walls contain sealed air spaces obtained by reversing the setting of the 4 in. hollow tile cells every 8 ft and locating them between an 8 in. brick outside wall and a 4 in. brick inside wall. The roof was insulated with 2 in. of cork and, in addition, a 4 in. water pan was maintained during summer operations.

Recommendations on the use of double glazing vary. Inside design conditions below 75 F dry bulb in summer or above 25 percent relative humidity in winter indicate the consideration of this feature. However, calculations can be made to compare the investment cost for the double glazing with the reduction in investment cost in heating and cooling equipment, as well as the reduction in operating costs.

In recent years there has been much publicity concerning sealed construction or the windowless plant. There is considerable controversy among architectural engineers and designers as to the merits and disadvantages of this type of structure. Some engineers believe that the blackout type plant has a considerable psychological hazard and this point poses several air conditioning problems. Occupants who are not able to glance out and occasionally see the outside weather conditions are much more sensitive to temperature changes and air currents. Consequently, careful control of temperature and drafts is of primary importance. In addition to the psychological problem, care must be taken to properly balance outside air, exhaust air and relief openings to prevent excessive air velocities through what few openings may be available. Well designed plants with a minimum of ventilating openings will probably be the rule in future design.

Fire protection and fire loss prevention are problems demanding careful attention, particularly in multistoried combustible buildings. Fire dampers and automatic controls should be installed to provide ample protection. When fire breaks out, these safeguards operate to close fire dampers in the return air ducts to prevent recirculation within the fire area; the outside air intake is opened wide so that the fan will force smoke and heat from the building through relief openings in the walls. Factory Mutual Bulletin No. 8.24, published by Associated Factory Mutual Fire Insurance Cos., Boston, gives recommended arrangements for fire safety for windowless buildings.

What Design Conditions To Use

Outside design data may indicate both average design conditions and maximum conditions. Which of these to use will depend upon the nature of the inside design conditions, the relative duration of maximum conditions, the effect of a slight slip in inside conditions on the product and other safety factors in the load calculations. If the installation is primarily for worker efficiency, stand-

ard design conditions should be acceptable in most cases.

Proper inside conditions for summer air conditioning installations are still a subject of considerable controversy. Where certain products require specific inside design conditions (and these will be exceptional cases) they usually are definitely known by the purchaser.

Beyond the requirements of specific products, there is considerable leeway open to the designer. To indicate some typical conditions, the following are cited. As far back as 1937, the Ford Motor Co. had established design conditions of approximately 80 F dry bulb and 45 percent relative humidity to improve upon the previous standards of 80 F and 50 percent. One of the RCA plants was designed for 75 F dry bulb and 45 percent in summer with 30 percent in winter. An aircraft factory in Philadelphia was designed for 78 F and 50 percent with one of its other shops designed for 80 F db and 48 percent. An underground precision instrument installation was designed for 69 F and 40 percent.

With the trend toward lower inside design conditions, care must be taken not to go too far for fear of entering the zone of thermal shock experienced by persons passing from a hot, humid outside atmosphere to cold inside temperatures of 70 F to 71 F dry bulb.

Where temperatures below 75 F to 80 F dry bulb are required, two possibilities are suggested. It is possible to maintain an intermediate temperature in lobbies, locker rooms or other intermediate spaces; or it may be desirable to raise the average inside temperature of the entire building during shift changes.

A paper presented before the ASRE recommended inside design conditions of 78 F dry bulb with 45 percent relative humidity, giving an effective temperature of 72. (As compared with 74 deg effective temperature with 80 F db and 50 percent). The increased load and horsepower per ton are only in the nature of 10 percent and it is often possible to make an air quantity reduction of about 20 percent. It is recommended that serious consideration be given to the use of inside design conditions of 78 F dry bulb and 45 percent relative humidity where the decision is left to the designer.

Operating limits on the inside design conditions usually will not be a factor. Most manufacturing plant air conditioning installations require only ordinary temperature control systems. As was pointed out earlier, precision air conditioning (close temperature and humidity limits) is the exception rather than the rule when job conditions are carefully analyzed. Usual good design practice and usual temperature control systems will provide conditions well within the operating limits of most installations.

Most manufacturing plant air conditioning installations will differ from comfort installations in that the air conditioning system will be required to maintain inside conditions (within reasonable limits) 24 hr a day for 365 days of the year. This is true whether the plant operates more than one shift or not. Finely finished surfaces cannot be left exposed to an unconditioned atmosphere overnight nor can parts which are to be precision machined or assembled be expected to change temperature as quickly as the air conditioning system is able to provide comfortable working conditions after a night's shutdown. The air conditioning must also be continuous when hygroscopic materials are involved. Only when the air conditioning is solely for worker comfort can it be shut down at night.

With the extreme load variations that are possible between the daytime peak and the night or weekend load, it may be necessary to develop time vs. load curves to assure that adequate flexibility in equipment capacity is available. To meet seasonal variations, this same factor may have to be considered. It is seldom that a plant will require or insist upon the same design conditions for winter and summer. Therefore, some means of making the transition will be necessary. Temperatures can be adjusted weekly or monthly during weekends or shutdowns from a winter inside condition of 68 F dry bulb to a summer inside condition of 78 to 80 F.

Ventilation requirements may be unusual due to the large amount of exhaust required or the building design. For exhaust requirements, reference can be made to the ASHVE Guide and to the previously mentioned article by L. R. St. Onge. For large windowless (or minimum ventilating sash) structures with extremely high ceilings, the outside air quantity may be as low as 10 percent or less. With high ceilings and 1 to 1½ cfm per sq ft of floor area, 20 to 30 minutes can be required for one air change.

Chilled Water or Direct Expansion?

The types of air conditioning systems available for manufacturing plants are as varied as they are for other applications. However, there are several pertinent features to consider. One of the first decisions to be made is the selection of the basic refrigeration system, either direct expansion or chilled water. A survey among several consulting engineers resulted in answers ranging from 15 tons to 200 tons as the breaking point between direct expansion and chilled water.

No sharp line can be drawn but usually direct expansion is considered first when the total load is less than 100 tons and chilled water is considered first when the load is more than 150 tons. In either case, other factors might influence the decision. In manufacturing plant air conditioning, the general tendency has been to install chilled water systems, first, because of size and, second, because of simplicity of control and flexibility of operation.

The decision between chilled water in coils and chilled water in air washers is somewhat more difficult. Each installation will have to be analyzed individually and such factors as length and size of chilled water lines, pump horsepower, first cost and facility for control will have to be weighed.

The merits of a central plant installation utilizing air conditioners at various load centers as opposed to the completely segregated unit system of approximately 100 tons has been argued pro and con by many air conditioning engineers. The decision between these two systems will have to be made on a job to job basis.

Since many industrial applications involve low humidities, chemical dehumidification systems are often considered. Some consulting engineers recommend the consideration of chemical dehumidification whenever the room dewpoint temperature is 45 F or lower, while others be-

lieve such systems should be considered only if the supply air temperature to the room is 35 F or lower. Chemical dehumidification may be lower in initial cost than mechanical refrigeration when the final air dew point off equipment is 40 F or lower.

Temperature control systems will seldom differ from those used for comfort air conditioning applications. Reheat and dew point control are used in manufacturing plant air conditioning installations more often than in human comfort installations.

The conventional ventilation system for a large manufacturing plant installation usually involves an overhead air distribution system with duct work above the bottom chord of the truss with returns located at the individual fan units, or in some special cases, along the walls near the floor line. Little generalization beyond this is possible.

Before leaving the subject of types of air conditioning systems, the heat pump or reverse cycle refrigeration system must be mentioned as a possible system for future installations.

Industrial Air Conditioning's Future

At his election in 1946, the president of ACRMA made this statement in connection with the future market for air conditioning and refrigeration: "War and other recent developments have opened many new fields. Air conditioning and refrigeration have become integral parts of numerous manufacturing processes, which a few years ago were conducted without any consideration of controlled temperatures or humidities. During the war, the number of metal working plants employing air conditioning increased more than 10 times. Air conditioning has become essential in precision manufacture and also in work calling for highly polished surfaces which are easily ruined by dust or perspiration. Our American productive system continually demands greater speed and higher standards of uniformity and precision. Almost invariably these demands mean that temperature, humidity and air cleanliness must be controlled."

In January 1944, Walter L. Fleisher, a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, commented along the same line in connection with his predictions of air conditioning as a "billion dollar industry." In addition to building and maintenance cost features, this consultant brings up the very pertinent issue of the labor factor. The more that labor becomes acquainted with working in "controlled atmospheres" the more it will become an assumed working condition.

This attitude is also confirmed by many consulting engineers. The accuracy of these forecasts is borne out by an action of the textile worker's union, which has made the subject of air conditioning in textile mills a positive matter for contract negotiation discussions with mill operators. They have backed up their arguments with a technical bulletin discussing the subject of air conditioning and its advantages to the mill operator as well as the worker. Any step such as this by one labor organization will certainly be followed in the future by others. Another survey indicated that over 83 percent of general factory employees favored the use of air conditioning in the manufacturing plant.

Attempts to predict the specific direction of the future market for air conditioning in precision manufacturing industries are difficult in view of the scope of the field and range of sizes of installations. An Austin Co., official believes the automotive industry is a long range, large market for air conditioning.

In general, it can be said that there is a market for air conditioning in any manufacturing plant coming within the scope of either of two primary motives: (1) requirements of the product itself; (2) worker comfort and production efficiencies. A need for air conditioning, justification for its use and hence "the market" will exist in any manufacturing plant where (a) the product handled is of a hygroscopic nature; production operations are of a high precision type; or quality of product or control are of extreme importance; or (b) worker concentrations are high; internal heat loads are high; worker efficiency and labor costs are a strong element in total product cost.

The future market for air conditioning in manufacturing plants can be summed up with the statements of a few outstanding engineers. In a discussion before the American Institute of Architects, C. S. Leopold stated that, "Throughout the country there has been a wide application of air conditioning in industry, both for product control and workers' efficiency. Due to the vast number of people who, for the first time, are now working in air conditioned spaces, there will be an accelerated demand for air conditioning similar to that which occurred in the twenties." Albert Kahn, in a more cautious vein, made the following statement, "So while we cannot assure the air conditioning industry a great market for air conditioning in all of our buildings, we do believe that the opportunities for air conditioning in industry are steadily growing. More than that, the growth is healthy because in our case, where we recommend air conditioning, it is because it is justified and proves itself to be a sound investment." The Austin Co. sums the subject up with the statement that, "Uncontrolled atmosphere, long recognized as one of the greatest handicaps to maximum production efficiency because of its effects upon workers, quality and output, seems destined to become as obsolete as the carbon filament lamp."

[Reasons for and advantages of air conditioning precision manufacturing plants were reviewed by Mr. Miner in an article in the July HPAC.]

BIBLIOGRAPHY

When Is Complete Air Conditioning of the Modern Factory Advisable, H. A. Mosher, Heating, Piping & Air Conditioning, June 1945.

Should Factories be Air Conditioned, Tutt, Goohs and Tykle, Heating, Piping & Air Conditioning, January 1945.

Conditions for Comfort, C. S. Leopold, Heating, Piping & Air Conditioning, June 1947.

Postwar Air Conditioning A Billion Dollar Industry, W. L. Fleisher, Heating, Piping & Air Conditioning, January 1944.

Air Conditioning Saves Six Years in Making World's Largest Mirror, M. M. Lawler, Heating, Piping & Air Conditioning, November 1935.

Man-Made Weather for Metalworking, E. J. Tangerman, American Machinist, October 1946.

Why A "Controlled Conditions" Plant?, The Austin Co.

Air Conditioning Is a Tool, Architectural Forum, December 1941.

Maritime Commission Gears Hobbed in Air Conditioned Rooms, M. Kennedy, Heating and Ventilating, April 1944.

Air Conditioning at the Agfa Ansco Film Warehouse, H. W. Sachs, Heating and Ventilating, August 1937.

Air Conditioning Aids in Artillery Optical Equipment Manufacture, Heating and Ventilating, August 1943.

Design for Defense, Albert Kahn, Heating and Ventilating, January 1941.

Profits in Air, C. O. Herb, Heating and Ventilating, March 1943.

Year 'Round Air Conditioning at Studebaker Plant, G. H. Jordan, Industry and Power, August 1945.

Reducing Heat Loads in Industrial Air Conditioning, L. R. St. Onge, Refrigerating Engineering, January 1946.

Safety in Boiler Operation

A brief history of uniform boiler laws and a discussion of the new Illinois boiler safety act

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PUBLIC OFFICIALS began to concern themselves with the safety of boilers operating within their jurisdictional limits around the beginning of the present century. Prior to 1911, several state legislatures had enacted laws regulating the construction of boilers which could be operated within their respective state boundaries. At that time, the governing bodies of some of the large cities had also adopted ordinances which required that any boilers operating within their respective corporate limits must meet certain specifications.

Since there was no uniformity in the laws or ordinances which had been adopted by the different political entities manufacturers were unable to build boilers which could be used in all of the different areas where their customers were located. Some of the officers of the American Society of Mechanical Engineers who were active in 1911 recognized this problem and a committee was appointed to formulate a boiler construction code. This committee — with changing membership — has been continuously active since its inception.

ASME Boiler Code Issued

The ASME boiler construction code was issued in 1914, and in its original and amended forms it has been increasingly useful in providing reasonable rules for the construction of boilers. The manufacturer who follows these rules in building boilers can be confident that his product will operate safely and give satisfactory service for a long period — providing, of course, that his boilers are used in the type of service for which they are intended.

By adopting rules and regulations which require that all boilers installed within the area under its control shall conform to the ASME boiler construction code, any governmental body can guarantee that its constituents will be protected from hazards due to the operation of boilers of faulty construction — without causing the confusion within the boiler industry which existed after the adoption of the first non-uniform regulatory measures.

The Uniform Boiler Law Society

After boiler rules and regulations were adopted and put into effect by a few governmental bodies willing to pioneer in this area, it soon became obvious that uniformity was also needed in their administration.

The American Uniform Boiler Law Society — a non-political, non-commercial, non-profit technical body — was organized in 1916 for the specific purpose of fostering the adoption by cities, states or Canadian provinces of uniform boiler laws based on the ASME boiler construction code. This organization also promotes the adoption of uniform regulations and practices in regard to the regular inspection of boilers and pressure vessels to make certain that they are properly equipped with safety devices which are properly applied and properly maintained.

Due largely to the untiring efforts of representatives of this group, 32 states, 36 cities, all of the provinces of Canada, most of the territories of the U.S.A. and several other countries have legally adopted essentially uniform laws regulating the installation and use of boilers within their respective jurisdictional limits.

Boiler and Pressure Vessel Inspectors

In an effort to provide a means of securing uniformity in the administration of uniform boiler laws, the National Board of Boiler and Pressure Vessel Inspectors (called the "National Board") was formally organized in 1921. The membership of the National Board consists of the chief inspectors (or equivalent officers) of all the political subdivisions of the United States and Canada which have adopted one or more

sections of the ASME boiler construction code.

The principal objective of this organization is to promote uniformity of procedures and policies in all local inspection work. As an important means to this end, the board — through the office of its secretary-treasurer — prepares uniform examinations which are taken by applicants for the position of boiler inspector. The examinations are given by examining boards in the different states, provinces or cities but each applicant's paper is sealed and returned to the secretary-treasurer of the National Board for grading by its examining committee. If an applicant passes, the local examining board is notified and a certificate of competency is issued to him by the governmental subdivision conducting the examination. The successful applicant may then also receive a commission from the National Board by making application to the secretary-treasurer and the payment of a nominal fee. An inspector holding a National Board Commission can usually be qualified to do the same type of work for any other political subdivision which has an officer who is a member of the National Board, without taking another examination.

Among its other services to its members, the organization publishes the National Board inspection code, which is a manual for the use of the inspector in the field containing most of the information he needs. This inspection code is coordinated with and makes frequent reference to the ASME boiler construction code.

Illinois' New Boiler Safety Act

The boiler safety act passed last year by the Illinois state legislature created a board of boiler rules within the state's department of public safety. This board serves without salary, but traveling expenses involved in attending meetings are allowed. The board members are appointed by the governor.

The act stipulates that certain interests are to be represented as, follows:

Of these seven appointed members, two shall be representative of owners and users of boilers within the state, i.e. one representing owners and users of high pressure boilers in utilities, manufacturing or processing, who shall be registered in accordance with the Illinois professional engineering act, and one representing the owners and users of low pressure boilers in commercial buildings, multiple housing or hotels. Of the remaining five appointed members, one shall be a representative of the boiler manufacturers within the state, one shall be a representative of a boiler insurance company licensed to do business within the state, one shall be a mechanical engineer on the faculty of a recognized engineering college, or a graduate mechanical engineer having equivalent experience, but in either case he shall be registered in accordance with the Illinois professional engineering act, one shall be a representative of the boiler makers and one shall be a representative of the practical steam operating engineers. The board shall elect one of its members to serve as chairman and at the call of the chairman, the board shall meet at least four times each year at the state capital or any other place designated by the board.

The act stipulates that the board is to formulate rules and regulations for the construction, installation, repair and operation of boilers within the state. The act further stipulates that "the rules and regulations formulated by the board shall have the force and effect of law except that the rules applying to the construction of new boilers shall not be construed to prevent the installation thereof until 12 months after their approval by the department of public safety." While the act leaves the wording of the rules in the hands of the board, it suggests that those referring to construction be based on the ASME boiler construction code.

This boiler safety act does not apply to cities having a population of 500,000 or more. Chicago, which had satisfactory rules in operation at the time the act was prepared, is thereby excluded from its provisions. It does not apply to boilers under federal control nor to unfired pressure vessels other than boilers. The following classes of boilers are exempt from all rules relating to inspection procedures:

1) Boilers located on farms and used solely for agricultural purposes.

2) Steam boilers used for heating purposes carrying a pressure of not more than 15 lb per sq in. gage and which are located in private residences or in apartment houses of less than six families and steam boilers used for heating purposes carrying a pressure of not more than 10 lb per sq in. gage and having a rating of not to exceed 1200 sq ft of radiation.

3) Hot water heating boilers carrying a pressure of not more than 30 lb per sq in. gage, and which are located in private residences or in apartment houses of less than six families.

Small steam boilers operating at pressures greater than 15 lb per sq in. gage, or small hot water boilers operating under a pressure greater than 30 lb per sq in. gage are subject to the provisions of the act. Boilers of these types are referred to in the rules as miniature boilers.

The act specifies that enforcement of the rules is to be under the direction of a chief inspector having certain prescribed qualifications and who is appointed by the director of the department of public safety. The act also provides that the department of public safety employ properly qualified deputy inspectors to assist the chief inspector and to be responsible to him. The act further provides that qualified inspectors in the employ of insurance companies authorized to insure against loss from explosion of boilers within the state may be appointed as special inspectors who will report the results of their findings in each case to the chief inspector. In other words, inspectors in the employ of the state will not regularly inspect boilers properly covered by insurance.

Section 15 of the act, applying to self-insurers, reads as follows:

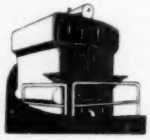
Any owner or user of boilers subject to section 10 of this act (the section which specifies inspection procedure), who maintains and operates, under the supervision of one or more regularly employed professional engineers, an inspection or maintenance service in which one or more inspectors are regularly employed on inspection work, including the inspection of boilers operated by such user, shall, upon application to the director showing such fact and a showing that such user is possessed of financial ability to bear any loss and to pay all final judgments or awards obtained against such user by reason of the operation of such boilers, be authorized to act as a self-insurer of his or its boiler explosion risk in this state; and when so authorized such user and the inspectors regularly employed by such user shall be entitled to all the rights and privileges and shall be subject to all the requirements, duties and obligations provided in this act respectively for boiler insurance companies and inspectors employed by such companies.

The act specifies that any person aggrieved by an order or act of the chief inspector may within 15 days after notice thereof appeal from such order or act to the board. In the event of an appeal, the board is directed to hold a hearing within 30 days, after having given at least 10 days' written notice to all interested parties. Within 30 days after the

hearing, the board shall issue an appropriate order, sending a copy to all interested parties.

Publication of the Boiler Rules

The boiler rules and regulations which have been formulated by the board of boiler rules of the state of Illinois follow the general pattern and content of those recommended by the American Uniform Boiler Law Society. Some changes were made in order to conform with the specific stipulations and exemptions incorporated in the Illinois boiler safety act. The act and the rules and regulations are incorporated in a booklet entitled 1952 Boiler Safety Act and Boiler Rules and Regulations, copies of which may be obtained by writing B. A. Bailey, Chief Inspector, Division of Boiler Inspection, 206½ E. Monroe St., Springfield, Ill.



The booklet is divided into four major divisions devoted to: (1) a reprinting of the boiler safety act; (2) definitions; (3) administration; and (4) construction, installation, inspection, maintenance and use of boilers. The following paragraphs include some selected highlights from the last two sections. The items selected are those thought to be of greatest concern to the reader within the state who is the owner or operator of a boiler coming under the provisions of the act. Statements which are quoted verbatim from the rules are enclosed in quotation marks.

Registration of Boilers — The following is an excerpt from the rules covering the responsibility of the owner in regard to registration. "Within six months from May 1, 1952, all owners or users of boilers, subject to the boiler safety act, now in use or installed ready for use in the state, shall report to the chief inspector on forms prescribed by the department of public safety, giving the location, type, capacity, age and date of installation."

Inspection of Boilers — Power boilers shall be inspected annually both internally and externally while not under pressure and shall also be inspected annually while under pressure if possible. Low pressure heating boilers shall be inspected both internally and externally biennially where constructions will permit. Miniature boilers must be inspected and stamped upon completion of the installation. The stamping must not be concealed by lagging or paint. The owner or user shall prepare each boiler for internal inspection and shall prepare for and apply a hydrostatic test whenever necessary, on the date specified by an inspector.

New Boilers — After May 1, 1953, no new boiler which is in a classification coming under the coverage of the act can be installed within the state unless it has been constructed, inspected and stamped in conformity with the applicable section of the ASME boiler construction code. A boiler having the standard stamping of another state that has adopted an equivalent standard of construction may be accepted by the chief inspector after he has received from the owner an application containing the necessary information. After the completion of the installation, all new boilers covered by the act shall be inspected by a qualified inspector and, if approved, stamped at that time with a serial number of the state of Illinois followed by the letters "ILL".

Existing Installations — Any boiler installed and placed in operation in the state of Illinois prior to May 1, 1953, which is covered by the boiler safety act, must be registered by its owner and will in due course be inspected by a qualified inspector. The maximum allowable working pressure shall be determined by the strength of the weakest section computed by the methods prescribed in the appropriate section of the ASME boiler construction code. The factor of safety used in the computation shall be increased by the inspector if the condition of the boiler demands it. The lowest factor of safety permissible on existing installations shall be 4.5. A factor of safety of at least 8 shall be used in determining the maximum working pressure for a horizontal return tubular boiler having a continuous lap seam more than 12 ft in length.

"Reinstalled or second hand boilers shall have a minimum factor of safety of 6 when the longitudinal seams are of lap riveted construction and a minimum factor of safety of 5 when the longitudinal seams are of butt and double strap construction."

"The factor of safety of non-standard existing installations or re-installed installations shall be increased by five-tenths (0.5) at the commencement of each 5 year period after the effective date of these rules and regulations."

"The age limit of a horizontal return tubular, flue or cylinder boiler having a longitudinal lap joint and operating at a pressure in excess of 50 lb per sq in. gage shall be 30 years. A reasonable time for replacement shall be given at the discretion of the board of boiler rules."

The maximum allowable working pressure of any water tube power boiler using cast iron or malleable iron headers or mud drums is limited to 160 lb per sq in. gage and cast iron steam boilers may not operate at a pressure exceeding 15 lb per sq in. gage.

The rules also contain specific requirements in regard to safety valves, boiler feeding and feed piping, fusible plugs, water columns, gage glasses, pressure gages, stop valves and blowoff piping. Recommendations are included in regard to ladders, runways and exits from the boiler room.

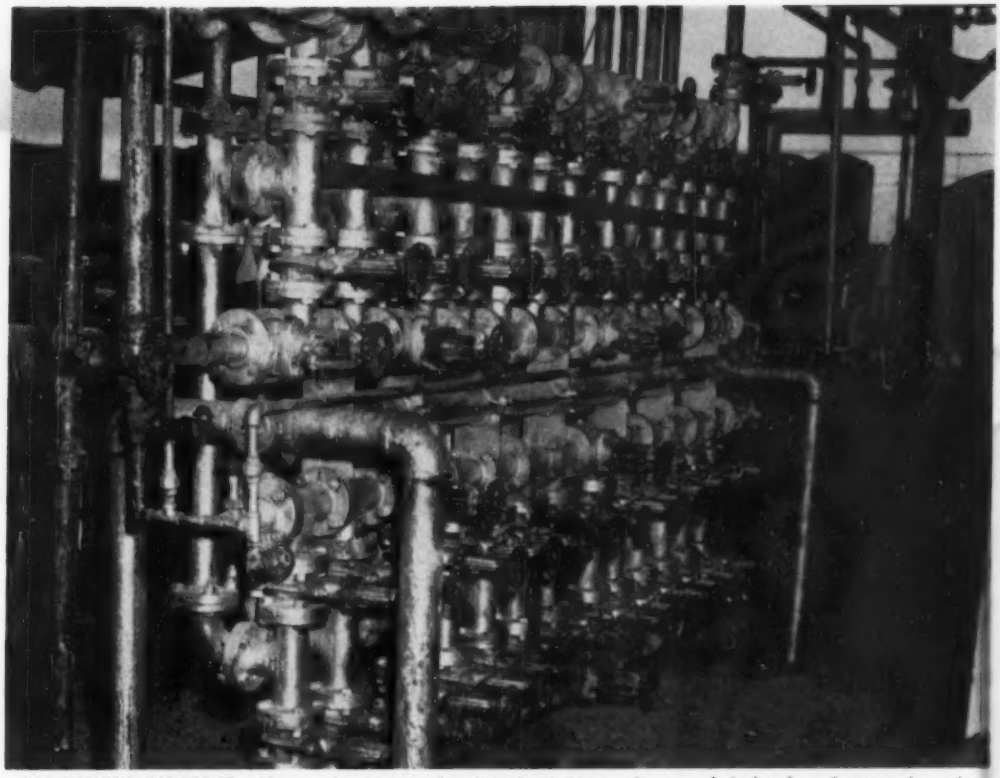
SEEK TO SPEED HEAVY WALL PIPE DELIVERIES

At a special conference held by the National Production Authority, and called upon the recommendation of representatives of the Fabricated Metal Piping Industry Committee, ways were formulated to expedite delivery of large size heavy wall pipe for the power, electrification and petroleum expansion programs now under way.

As a result of the conference, the American Standards Association was asked to review the possibility of further standardizing specifications for heavy wall pipe.

Representatives of the various industries present at the conference expressed the belief that simplified standardization practices would speed deliveries of heavy wall pipe.

Heavy wall pipe is defined as that having a thickness of ⅞ in. or more and having an outside diameter of from 8⅝ to 18 in.



FOUR VALVE PANELS like this control movement of various chemicals to or from any desired tank or the processing units

Valve Panels Control Flow

By R. L. Hedberg
Assistant Manager
Charlotte Branch, Crane Co.

Control of large number of pipe lines at a naval stores plant is centralized and simplified

THE GLIDDEN CO.'s naval stores division, at Jacksonville, Fla., is one of the larger manufacturing plants in that area using local products to produce chemicals and resins for consuming industries.

During extensive alterations of this plant, the idea was conceived by the Glidden engineering staff of incorporating control stations at strategic points in the plant. This was intended to centralize as well as simplify control of the vast number of pipe lines throughout the tank farms and processing equipment.

It was accomplished by setting up control panels in such a way that operating a number of valves in a panel will allow any one of the various chemicals to be moved to any desired tank in the tank farm from another tank, or to or from the processing units. Pumps operated by steam or electricity as prime movers are also incorporated into this setup in order to keep the entire system moving smoothly.

By setting the proper valves in the panel, more than one fluid can be controlled at one time.

The photo shows one of the four different control panels located in the center of operations, all serving a specified purpose. Each valve in a panel is tagged with its operation so that any combination of operations can be accomplished with little lost motion.

About 175 2 in. flanged gate valves are used in these panels, with an undetermined number elsewhere in the plant.

No More "Shirtsleeve Conventions"

By Maurice E. Fine

Mechanical Engineer
A. Epstein and Sons, Inc.
Engineers and Architects

THE EYES AND EARS of the Nation were focused on the national political conventions last July. This brought tremendous publicity to the installation of air conditioning in the International Amphitheatre, Chicago, where the conventions were held [and the scene of next month's International Heating, Ventilating and Air Conditioning Exposition.]

Probably no other air conditioning job has had the national spotlight turned on it with such intensity. Interspersed with political comments during the conventions were remarks on the performance of the air conditioning. At one point, there was even a controversy on the air and in the press as to whether the air conditioning was functioning.

This caused considerable talk, and I received numerous calls questioning the ability of the air conditioning system to meet the cooling loads of the building. I spent some time running down these stories and found that, in one case, an independent self-contained cooling unit, installed by one of the broadcasting studios, had lost its refrigerant charge. The uncomfortable announcer assumed that the delegates and spectators were suffering, too, and said over the air that the main air conditioning system had broken down. The other rumors were similarly without foundation.

Prior to the convention, a special ceremony was arranged to demonstrate to the convention officials of both parties — as well as the public — that the air conditioning installation would fulfill the promise made to keep the delegates cool and comfortable. Several hundred guests representing political, industrial and business leaders were in attendance when Mayor Kennelly threw the switch which started the refrigeration and air conditioning equipment.

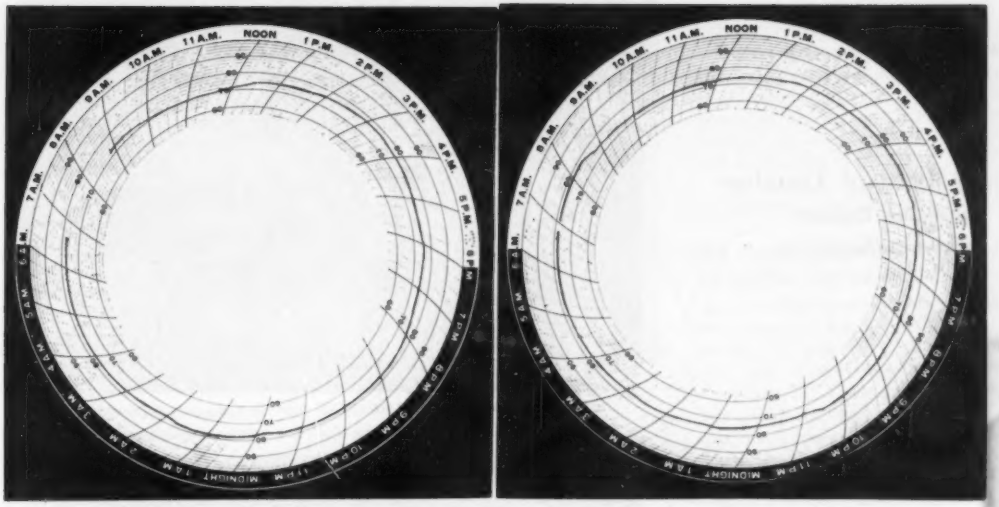
A large chart 40 ft high was rigged up to indicate the "before and after" temperatures. It was 80 deg in the Amphitheatre, although the outside temperature was 73 deg. The guests had been invited to a luncheon at the nearby Saddle & Sirloin club. Meantime, the system was put to its maximum effort to lower the temperature in the Amphitheatre as much as possible in the given time, in order to demonstrate to all the effectiveness of the newly installed system.

Late afternoon editions of newspapers graphically stated on their front pages that the system "worked". A recording thermometer indicated that the indoor temperature had fallen to 69 deg in 1 hr and 15 minutes. The enthusiastic political and civic leaders hailed the demonstration as a success and agreed that the coming conventions would be the coolest in history.

The chairman of the GOP convention stated in the public press that "this represents the fulfillment of Chicago's promises to both parties, when civic leaders offered to guarantee air conditioning and thereby attracted the two conventions". Their enthusiasm could be appreciated, since they had the memory of the 1948 conventions still moist in their minds.

PHILADELPHIA PLANS

Philadelphia's city planning commission has included in its program air conditioning of the Convention Hall, where the 1948 national political conventions were held. Plans call for air conditioning the building by 1955.



THESE TWO RECORDER CHARTS for July 10 and 11 show the uniform temperature maintained in the convention hall

Real Test Came on Opening Day

Despite the press, radio and television publicity, the real test of the installation came on July 7, the opening day of the Republican convention. The test was an acid one, since the weatherman cooperated with a heat wave which produced temperatures of 94 deg and higher between 11 a. m. and 7 p. m. The attendance at 12:30 p. m., when the gavel fell starting the first session, was estimated to be 14,000 persons. In addition to the mass of humanity, the white hot glare of batteries of television lights, plus the normal lighting, was added to the heat load.

The accompanying table gives the temperature and relative humidity readings for the first day.

The effectiveness of the air conditioning installation can be judged by the fact that delegates and spectators retained their coats. One columnist said that "talking about fashions, this is the best dressed convention — thanks to the air conditioning plant. In years past, everyone went around in shirtsleeves."

It should be mentioned that only the arena portion of the Amphitheatre is air conditioned. The adjoining corridors and the north and south wings are not cooled. In order to separate the conditioned space from the rest of the structure, partitions with doors were provided at the main east entrance vestibule and at the west end of the arena. Closures were also installed at the west end of the third floor corridors. Doors were already provided between the main floor stands and the adjoining second floor areas.

It was felt that, with the proper instructions to ushers and other personnel, infiltration could be avoided. However, because of the heavy stream of traffic through the main entrance doors opening onto the street, and the steady movement of people in and out of the conditioned arena to the adjoining areas of the building, it was virtually impossible to avoid infiltration of unconditioned air. Ushers were instructed to keep doors closed when not in use, but inspection showed that it was a difficult task — since the ushers would hold the doors partly or even fully open in order to receive the benefits of the air conditioning.

CONDITIONS outside and inside the convention hall

Time	Outside Temp.	Inside Conditions Temp.	Rel. Hum.
11 a.m.	94	76	59
12 noon	96	77	55
1 p.m.	97	77	55
2	97	78	56
3	98.5	78	56
4	96	77	55
5	95	75	54
6	94	74	50
7	94	73	50
8	90	73	51

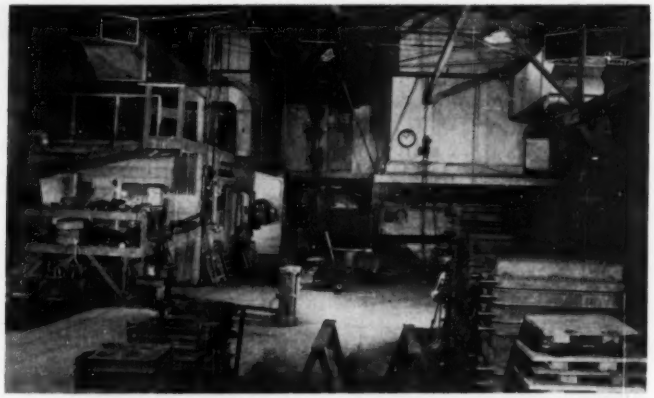
The air distribution system worked out very well, even though some of the lower supply outlets at the west end of the arena, where the speaker's platform was located, had to be blocked off completely due to the placement of temporary stands directly in front of a group of grilles. At the east end, a bandstand erected for the Republican convention was placed so that the floor of the stand came just over the battery of supply outlets. The air, instead of diffusing outward, was confined under the mezzanine and produced temperatures 8 or 9 deg lower than the average. When the stand was removed for the Democratic convention, this condition was automatically corrected. Bunting, which partly covered supply grilles along the balcony, also interfered with the air distribution.

Despite the many minor crises encountered in the development and operation of the air conditioning system, it can be reported that the performance met the highest expectations. Certainly, the days of the "shirtsleeve conventions" are going the way of the horse and buggy. The advantages of air conditioning received a big boost through the interest in this installation.

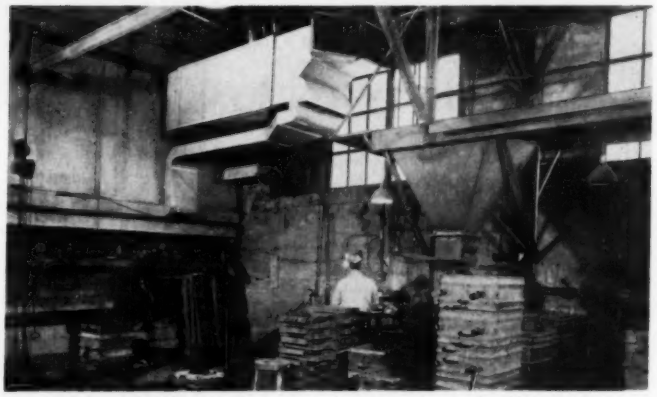
[How the International Amphitheatre was air conditioned was described by Mr. Fine in his article in the July HPAC.]

Foundry Solves Problem

By Bernard Czymbor
Installation Engineer
Jackson & Church Co.



SUSPENDED OIL FIRED HEATING unit at right serves pouring room and rear shipping room. Furnace at left has return air duct for recirculating air during non-working hours



THIS CLOSE-UP of one of the units shows how the angular plenum directs tempered air into working area

A HEATING AND ventilating problem in a Saginaw, Mich., foundry, serious enough to threaten the workers' health, has been solved by installing warm air furnaces and a new ventilating system.

The Saginaw Bearing Co. was plagued with a high rate of absenteeism among its shop workers. Lead fumes from the melting section of the 150 ft long rectangular building were a particular problem. Blamed for most of the trouble was the outmoded ventilating system.

One of the first changes made to alleviate the situation was to alter the canopy around the melting room by lowering it to within 8 ft of the floor, in order to keep most of the fumes from seeping out into the other working areas. Duct work was suspended over the pouring areas leading to overhead fans. The fans had previously been installed to carry the fumes from the melting furnaces and the melting area.

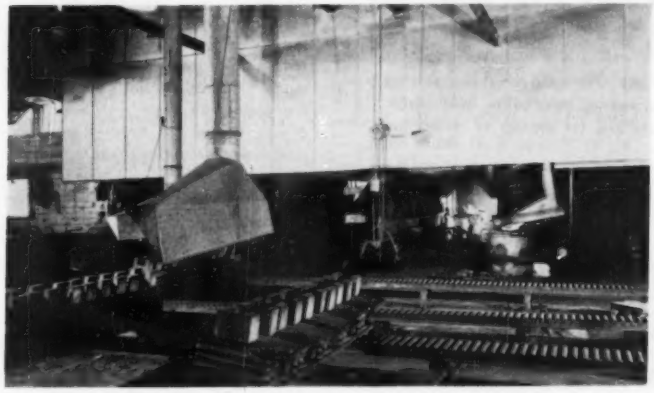
Two Suspended Furnaces Installed

Two oil fired suspended furnaces, each with a 450,000 Btu output and a capacity of 5000 cfm of tempered air, were installed at corners of the 22 ft ceiling parallel to each other and at the opposite end of the room from the melting area. The only ducts needed were lead-ins for bringing outdoor air into the furnaces, angular plenums to throw the warm air in the desired directions, and a piece leading from one of the units to a rear shipping room.

It was determined that the new ventilating system should exhaust 22,000 cfm of air from the plant — meaning that 12,000 cfm of air had to enter the building by means other than the furnaces. This was provided for by installing two new wall fans close to the ceiling and near the melting area (which pours off enough heat to warm that section of the building.) Through a curtain arrangement, untempered air from the outside is introduced into the building so that it blends with the warm air around the canopy of the melting room before it has a chance to come in contact with the occupants.

While the area adjacent to the melting room receives ample warmth from the melting furnaces' heat plus the fresh air from the overhead fans,

MOST OF THE FUMES AND SMOKE originating from the pig molds during pouring operations are caught by these overhanging ventilators before they are able to seep out from under the canopy



FUMES ARE KEPT WITHIN low hanging canopy and are carried off by duct work suspended over molds. Melting pots are at right background

. . . . . of heating and ventilating to protect workers' health with suspended oil fired furnaces and new duct work

the balance of the working area is given a constant supply of fresh warm air because the two suspended units delivered their output into the room — keeping any fumes from the opposite end from floating out of their restricted area.

Heating Building During "Off" Hours

Because the plant does not work at night during the winter months, it is not necessary to keep a constant flow of air coming into the building during the "off" hours. The plant is moderately heated at such times by having the makeup duct on either unit closed off and a damper on another duct on the same furnace opened in order that the air inside the building can be drawn back into the furnace and recirculated. A bulb thermostat in the plenum of each unit makes it possible to keep the desired temperature during the day. The unit not needed during the "off" hours is shut off completely.

During the summer months when heat is not needed, the suspension units continue to act as ventilators. Fresh air is circulated through the building by keeping the blowers on and the burners off.

The new duct work was installed by the Frimberger Sheet Metal Co.

AIR CONDITIONING IS BIG POTENTIAL POWER USER

ALL-ELECTRIC year 'round air conditioning represents a great untapped source of potential kilowatt-hour sales for America's electric utility companies, H. M. Brundage, general manager of the General Electric Co.'s heat pump department, said at the annual meeting of the Southeastern Electric Exchange. Use of electric heating and air conditioning by the American public could triple or quadruple the current residential sale of electric power, according to Mr. Brundage.

Pointing to the tremendous possibilities for expansion in this area, he said that although there were over 400 million electric consuming devices in American homes today the average residential consumption of electricity, including lighting, "amounts to only 1900 kwhr per year."

Ideal Field for Two Reasons

"This is the area in which electric utilities should look to substantially increase their power loads of the future," he said. "It is an ideal field not only because of its great potential, but particularly because we will be making a distinct contribution toward improving the living standards of the American people".

Electric utility revenues from the use of major electric appliances will approximate $3 billion by 1960, more than double the $1.3 billion in 1951, the New York Society of Security Analysts was told by Clarence H. Linder, general manager of G.E.'s major appliance division.

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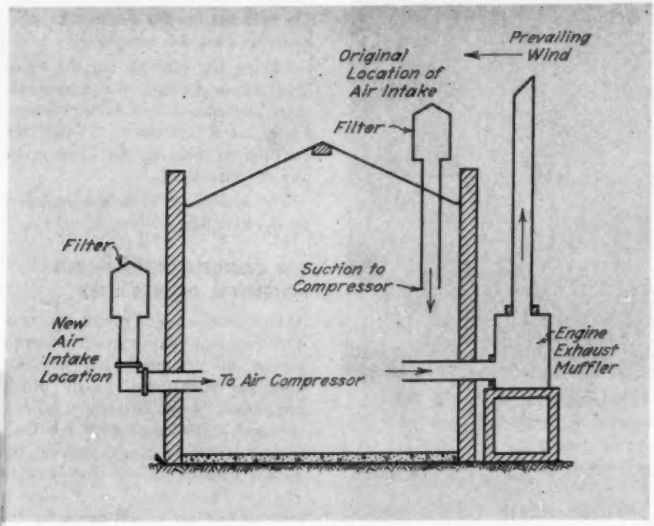
Watch for the complete Directory Section to be published in the January issue, which will classify heating, piping and air conditioning equipment, give complete addresses, and list trade names.



FILTER ON AIR COMPRESSOR INTAKE was close to exhaust pipe of oil engine, and prevailing wind directed exhaust gases to the compressor's air intake. The intake location was changed (as shown) to correct the trouble

Compressed Air Troubles

. . . . . and what caused them. Case histories show the necessity of good engineering and good operation

By C. T. Baker
Consulting Engineer

As ONE ASSOCIATED with — and active in — engineering "theory and practice" for quite a long time, I can recall many instances of failure of compressed air installations to operate satisfactorily. Sometimes the misfortune was easily corrected and was of short duration — but many of the cases on record show that the operating troubles were very costly in power consumption as well as in reduction in output.

Those who read this "record of the past" may be surprised to learn that, among the cases discussed here, there was not a single instance where failure could be blamed on the manufacturer of the machinery and other equipment. This may sound like fiction, but it's fact.

Sometime ago I was engaged to make an investigation of an air compressor that had been in service for several years. It was a two-stage machine, with the usual intercooler between the high and low pressure cylinders, and was directly connected to a 215 hp synchronous motor. Notwithstanding that both the compressor and motor were of well-known makes, each with a record of many years of successful performance behind it, both the plant engineer and the plant superintendent insisted that the unit was incapable of satisfactory performance, because (as they put it) "the compressor was not built right and the motor didn't fit."

Poor Power Factor, Other Troubles

My inspection disclosed some interesting facts. First, the compressor motor was overloaded. Second, all the suction and discharge valves of both cylinders leaked badly. Third, the low pressure cylinder was badly scored and had one broken piston ring; in addition, the center line of the piston was low — causing excessive piston rod wear — and friction losses occurring in this cylinder were extreme.

Fourth, the motor — which had a guaranteed efficiency of 91 percent at full load, 90.8 percent at three-quarters and 89 percent at one-half (all based on unity power factor) — was found to be operating at 80 percent power factor or less, which lowered its efficiency. This situation was corrected by installing a power factor indicator and by instructing the operators on the way to control field excitation of the motor so as to maintain unity power factor. This remedy was well worthwhile, as with this particular motor the difference in efficiency between 80 percent power factor and unity power factor was 2½ to 3 percent.

Unfiltered Air Did Heavy Damage

In investigating the causes of cut cylinders, leaky valves and other mechanical troubles, not much search was required to find the answers. The suction pipe to the first stage cylinder extended outside the engine room and then upward to about the height of the center line of the roof. No filter had been placed on this intake pipe to protect the cylinders from abrasive materials. Consequently, air heavily charged with foreign matter most of the time

passed through the compressor cylinders and valves, doing serious damage because of its abrasive action.

This condition had prevailed since the installation had been made some years earlier. Of course, the damage done — as well as the loss in air capacity and the increased power cost — had taken a heavy toll which could only be charged to ignorance, carelessness and indifference.

Unplanned Piping Meant Poor Distribution

When this installation was originally made, the compressed air-using equipment — such as drills, hammers, etc. — had been confined to a radius of not more than a hundred feet around the compressor station. But as time went on, the demand for compressed air had increased with the addition of shops which required more tools, pneumatic hoists, etc. — so, of course, more air lines had been installed. Unfortunately, no study was made to determine just how much additional air would be needed to accommodate the expansion of shop facilities, or just what the peak air demands were. All that was done was to extend the same size supply main to the new area of operations, in spite of the fact that the piping had hardly been of adequate capacity to take care of the original development.

Pressure loss tests over the areas in which the various shops were located revealed a deplorable condition. Just how the plant was ever able to turn out as much work as it did remains a mystery to me. The problem was solved, though, by installing mains and laterals of sufficient capacity to insure at all times maintenance of the required pressure at the points where it was needed.

It goes without saying that had a little commonsense been exercised in the installation and operation of this compressor, this story would never need to have been written.

Coal Dust and Ashes in a New Role

During the second year of World War II the government awarded a contract to a large concern for certain equipment needed by the armed forces — and, of course, needed at an early date. Fulfillment of the contract necessitated the use of considerable compressed air at 150 psig, so a compressor to meet the requirements was authorized through WPB for prompt shipment.

At the manufacturer's plant there was considerable discussion on the question of a location for the new compressor. However, the "best minds" among the management agreed that since the boiler room was so large — it contained four stoker fired boilers — that would be the best place for it.

On an incidental visit, some time after the installation, I looked over the boiler room at this plant. The new compressor constantly received the full benefit of ash and coal dust from the boilers, and to make matters worse, the air intake had been placed near the coal bin which was filled direct from the cars on the railroad siding above. While coal was being unloaded, the air was thick with dust and the compressor — operating without an air intake filter — pulled much of it straight to the low pressure cylinder. It requires no stretch of the imagination to see why such constant punishment to the cylinders and motor windings led to failure of the compressor to deliver its rated capacity.

Air Intake Location Causes Difficulty

As my office files go back 30 years or more, I could continue indefinitely to record stories of air compressor troubles. However, I believe one more case history will suffice to make the point that good engineering and operation are essential.

A 100 hp two cylinder diesel engine furnished electric power for a small manufacturing plant. Some time after the engine was installed, an air compressor was purchased to supply compressed air for certain operations. The air intake pipe of the compressor was extended vertically to a point just above the parapet wall of the building that housed the power plant machinery, and terminated very close to the exhaust pipe of the oil engine.

While the compressor was in operation, considerable engine exhaust was picked up — sufficient to cause serious damage to the metals of the compressor as a whole. Oil used by the engine ran fairly high in sulphur content and, when mixed with moisture in the air, produced a very destructive material in the form of sulphurous acid. There was a very simple solution to this problem — the air intake to the compressor was re-located so that there was no further danger of picking up the engine exhaust.

The constant repetition of cases of damaged equipment makes me wonder sometimes why the years have so often taught so little judgment in matters pertaining to the installation and care of valuable machinery. Why, too, do those guilty of bad installation and operation so often place the blame on the shoulders of the manufacturers who are in no way responsible for the acts of those who choose to proceed "without benefit of clergy" and with the confidence of ignorance?

AGC AGAINST SEPARATE MECHANICAL CONTRACTS

THE TEXT OF A statement authorized by the governing and advisory boards of the Associated General Contractors of America, summarizing the policy of the association on relationships between general contractors and specialty contractors in the construction industry, was released recently by H. E. Foreman, AGC's managing director.

The boards, recognizing the need for better relationships, have authorized the officers and executive committee to "initiate such cooperative actions as they deem appropriate, directed toward establishing more harmonious relationships."

The boards stated their belief that depositories for the bids of specialty contractors, the naming of specialty contractors in a general contractor's bid, or the award of separate mechanical contracts independent of the general contractor's bid "are not conducive to the most economical construction practices."

The boards adopted a motion that "recognizes the desirability of establishing better and closer relationships with specialty contractors, and urges that all chapters, branches and members individually of the AGC cooperate to this end, to correct any questionable practices so that harmony and confidence will be established in the industry."

Economical Duct Layouts

By Peter Franck
Chief Field Engineer
Armo Cooling & Ventilating Co.

Here's a method the author uses to select the most suitable duct arrangement of several possible choices

WE MAY PARAPHRASE the saying that "all roads lead to Rome" as "many duct layouts get the air to the outlets." For a given room, or even for a given location of outlets, different engineers will have different duct layouts for various reasons — such as even distribution, lower friction loss, ease of installation, lower installation cost, etc.

It is impossible to give generalized rules for the best layout. However, it is possible to analyze a simple duct layout more closely than it is usually done under the pressure of getting plans completed. But even in this closer analysis, we have to narrow the field by emphasizing one aspect and neglecting the others.

It is proposed to consider in detail here only three very simple layouts, and the only consideration will be the weight of sheet metal duct work, since this weight is roughly proportional to the cost of installation. The purpose of this investigation is twofold: (1) on many large installations a small saving per unit (e.g., per room in a hotel) becomes an important factor if it is repeated sufficiently often; and (2) some general rules may be deduced from these particular cases.

As a measure of the weight of the duct work, we will only compute the weight of the straight runs, it being assumed that individual take-offs for each outlet would be provided in any layout so that there is no appreciable saving effected there in one layout over the other. Nor do we compare the different layouts as far as friction loss (i.e., operating economy) is concerned because the difference of the layouts in this respect is negligible.

Rectangular Room With Four Outlets

Example A is based on a rectangular room with four outlets where the air conditioning unit (or the main duct trunk line) is located off one corner of the room. Fig. 1 shows the three duct layouts considered, and the dimensions a, b and c which characterize the set-up. We assume that each outlet is to handle 1000 cfm, and the ducts are designed on an equal friction basis of 0.1 in. per 100 ft. Table 1 then shows the required duct sizes on the basis of square ducts (which are most economical), an aspect ratio of 3:1 (which is chosen to allow for exigencies of the job conditions), or a maximum depth of 12 in. (which is the most common type of limitation).

In order to plot the weights for all different values of a, b and c on simple graphs, we divide the room dimensions and the resulting weight by a and then compare the values of W/a (weight W divided by length a) for different values of the ratios $r_1 = c/a$ and $r_2 = b/a$. The resulting graphs for the three different aspect ratios are shown in Figs. 2, 3 and 4.

For any given value of a, b and c, these graphs would give immediately the total weight of the duct work. Since, however, we chose an entirely arbitrary example (as to air volume and friction drop), we are really not interested in the absolute weights under the different schemes, but only in the comparison of one scheme to the other. This comparison is given by the "boundary lines" which slant from lower left to upper right on the graphs and which immediately show the most economic scheme for a given ratio of c/a and b/a. As shown on the graphs, these boundary lines divide the range of the variables (i.e., the room dimension ratios) into distinct regions in which the relative weights corresponding to the different schemes do not change.

In Fig. 5, only the boundary lines of Figs. 2, 3 and 4 are shown. We note here the adverse effect on the weight of metal by flattening the ducts. This increased weight affects the larger ducts most due to the effect of the aspect ratio for a given "circular equivalent", and the heavier gages that must be used for the wider ducts. Consequently, schemes I and III suffer most when the ducts are flattened since they have the longer runs with the full air quantity. In view of this general condition, it is not necessary to consider the influence of the aspect ratio on the economies of the duct layouts, and we will, therefore, consider the following examples only for the most common circumstance — namely, the limitation of depth of duct.

TABLE 1—DUCT SIZES for three different cases

Cfm	Equiv. dia.	Square duct	3:1 aspect ratio	12 in. maximum height of duct
4000	23.4	21.4 x 21.4	12.8 x 38.4	12 x 41.9
2000	18.0	16.5 x 16.5	9.9 x 29.7	12 x 23.2
1000	13.9	12.7 x 12.7	7.6 x 22.8	12 x 13.5

Elongated Room With Three Pairs of Outlets

Example B (Fig. 6) covers possible arrangements in an elongated room in which three equidistant pairs

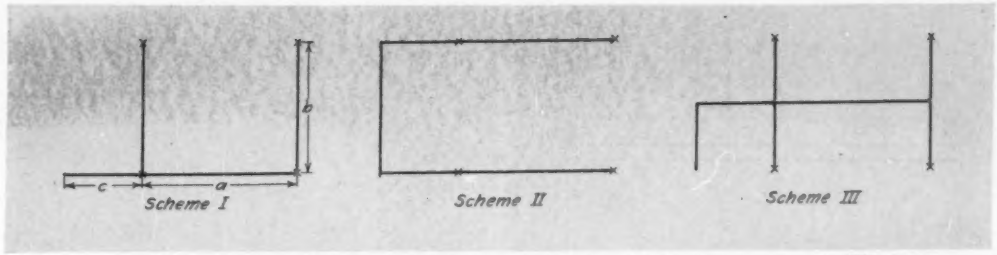


FIG. 1 — THE THREE DUCT LAYOUTS considered in Example A in the text. The points [illegible] marked "x" show the four air outlet locations

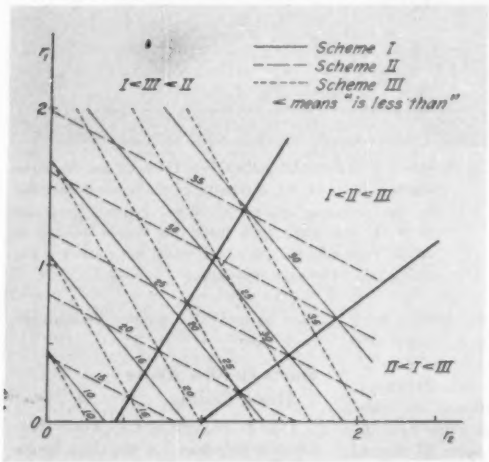


FIG. 2 — COMPARISON OF WEIGHT W divided by length a for different values of the ratios $r_1 = c/a$ and $r_2 = b/a$ for the three schemes shown in Fig. 1 (square ducts)

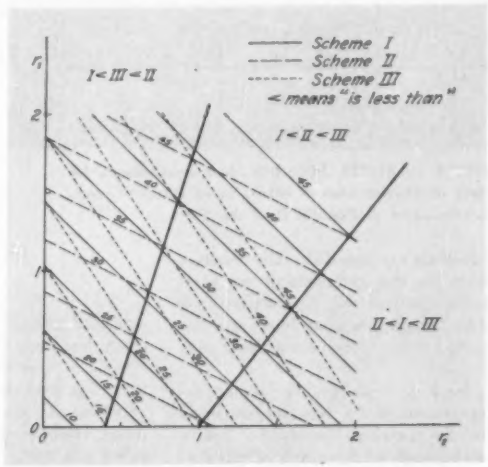


FIG. 3 — COMPARISON OF WEIGHT W divided by length a for different values of the ratios $r_1 = c/a$ and $r_2 = b/a$ for the three schemes shown in Fig. 1 (ducts with an aspect ratio of 3:1)

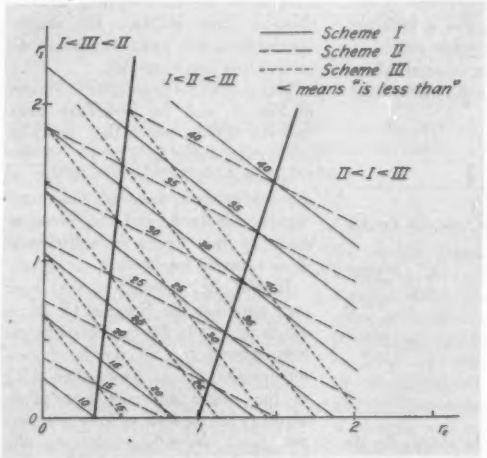


FIG. 4 — COMPARISON OF WEIGHT W divided by length a for different values of the ratios $r_1 = c/a$ and $r_2 = b/a$ for the three schemes shown in Fig. 1 (ducts with a maximum depth of 12 in.)

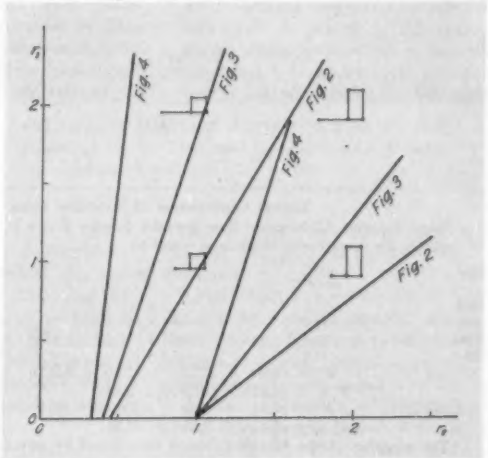


FIG. 5 — BOUNDARY LINES ONLY of Figs. 2, 3 and 4 are shown here. The adverse effect on the weight of the metal by flattening the ducts may be noted

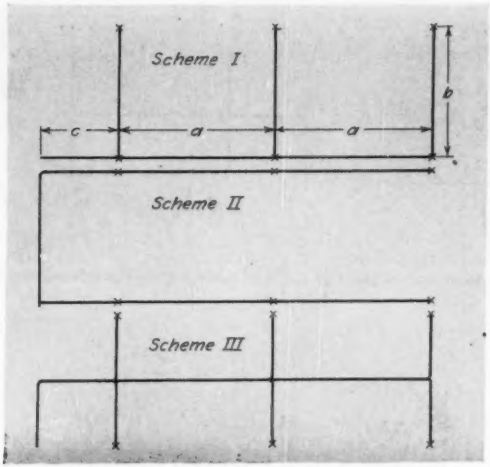


FIG. 6 — THREE POSSIBLE duct arrangements for three equidistant pairs of outlets in an elongated room, as considered in Example B of the text

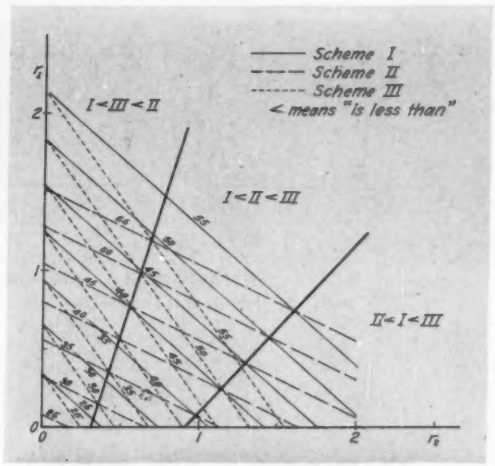


FIG. 7 — COMPARISON OF WEIGHTS for the three schemes shown in Fig. 6 (similar to the previous sketches for the preceding example). While Scheme III seems to be the one most often used, this sketch indicates it should be used only for a very long and narrow room with a relatively large approach, c

of outlets are installed. The assumptions for this arrangement are very similar to Example A; similar three duct layouts are considered and the same design conditions are prescribed.

In Fig. 7 we find a similar arrangement of the boundary lines as in the previous example. Yet a closer study of the graph reveals surprising results. By and large, Scheme III seems to be the most popular layout with engineers; but an inspection of the graph shows that for the most common spacing of the outlets ($r_2 = 1$; i.e., $b = a$) this scheme is the least economic except for very large values of c (c greater than $2a$). In fact, only for a very long and narrow room with a relatively large approach, c, should this scheme be considered, since it is always less economical than Scheme I.

Scheme II also affords an interesting example of the value of a detailed analysis: Scheme II should be considered whenever the approach is short or the room wide. The choice between Schemes I and II may often be delicate since a long approach may counteract the great width of the room. For a multiple installation involving many rooms of this type it would prove worthwhile to calculate the boundary line and then to make the proper decision in each case.

Ducts Hidden Above Hung Ceiling

Fig. 8 (Example C) shows four possible schemes for the duct layout in a large room. The first three correspond to the three layouts in the previous examples. The fourth is rather unorthodox but might be used where the duct work is hidden above a hung ceiling. The design assumptions are again the same as for the first two examples.

The graph of the weights is shown in Fig. 9, and the boundary lines and the regions which they separate are copied again in Fig. 10. A detailed analysis of Fig. 10 will not be given here since there are too many regions involved, and the arrangement of the figure is sufficiently clear to speak for itself.

It will be noted, however, how very superior the Scheme IV turns out to be. It is the most economical arrangement for all rooms of customary shape; i.e., wider than 6/10 of the length and not more than about twice as wide as long (the upper limit depending also on the length of the approach). The other schemes have approximately the same relative value as in the previous two examples.

Typical Computation of Boundary Lines

Using Example C, boundary line between Scheme I and II, first compute weights of ducts for the two schemes in terms of r_1 and r_2:

Cfm	Equiv. round	Duct size	Gage	Weight per ft
1000	13.9	13.5 x 12	24	4.91
2000	18.0	23.2 x 12	24	6.77
3000	20.9	32.3 x 12	22	10.38
5000	25.3	50.3 x 12	22	14.58

Scheme I: $W = 14.58c + 12.28b + (5.19 + 3.39)a$

$W/a = 14.58r_1 + 12.28r_2 + 8.58$

Scheme II: $W = 13.54c + 4.91c + (5.19 + 3.39)b + 12.28a$

$W/a = 18.45r_1 + 8.58r_2 + 12.28$

The equation of the boundary line is then found by equating the weights for the two schemes:

$$14.58R_1 + 12.28R_2 + 8.58 = 18.45R_1 + 8.58R_2 + 12.28$$

or

$$3.87R_1 - 3.70R_2 + 3.70 = 0,$$

where R_1 and R_2 are the running coordinates of the boundary line.

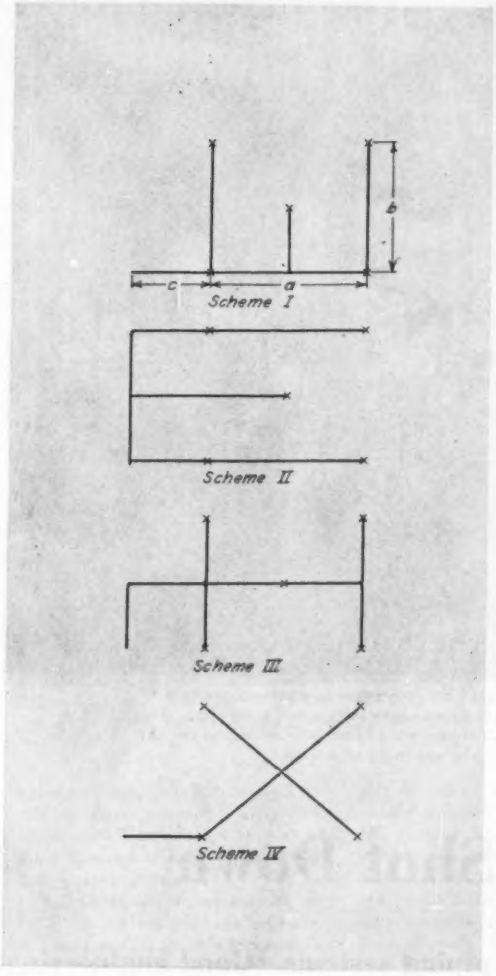


FIG. 8 — FOUR POSSIBLE SCHEMES for the duct layout in a large room, the fourth being for use where the ducts are hidden above a hung ceiling

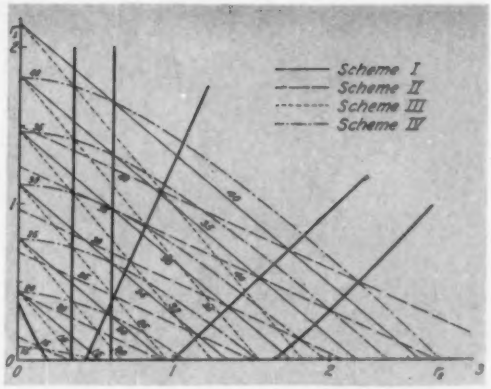


FIG. 9 — COMPARISON OF WEIGHTS — similar to the previous ones — for the four schemes sketched in Fig. 8

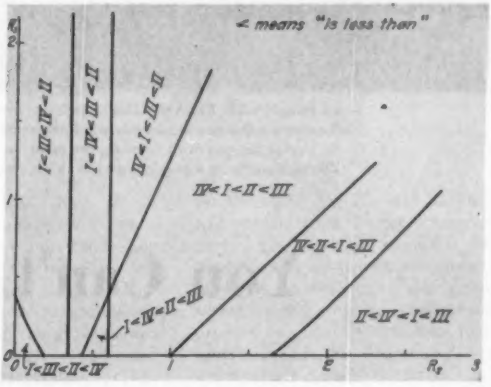


FIG. 10 — BOUNDARY LINES ONLY for the data plotted in Fig. 9. Note how superior Scheme IV turns out to be, says the author

What Such An Analysis May Show

The main conclusion to be drawn from these examples is that a casual guess as to the most economical duct layout may not always be correct and that a detailed analysis of different layouts may be warranted — particularly on repetitive jobs where a small saving per room may represent a substantial saving on the entire job.

It is to be remembered that the analysis in this article was quite arbitrary regarding air volumes and the design basis. The conditions shown on the graphs and the conclusions drawn from them may be quite erroneous even on a similar physical set-up due to different air volumes or other considerations. But the method of approach is valid, and the time spent on such an analysis may be well repaid.

Two rules in duct layout may be deduced which hold true fairly generally:

(1) Always let the air stream go forward, never doubling back. The doubling back consistently makes Scheme III less economical than Scheme I.

(2) Carefully consider if it is cheaper to combine several small ducts into one large one (which may necessitate a large aspect ratio and therefore an uneconomical duct size and often a heavier gage of metal) or to run separate branches to the different areas. This is the significance of the boundary lines on the graphs, which indicate where Scheme I ceases to be more economical than Scheme II.

12 IN., 135 LB STEAM LINE supplying five 1180 ton refrigeration compressors (in back of the electric driven machines in the foreground) is shown on the outside wall at the right. The tie line at the rear wall connects the pump steam header, which is out of the picture to the left. The sectionalizing valves referred to in the text can be seen in the 12 in. main

You Can't Shut Down

. . . . some piping systems. Good engineering, the right materials, and a good construction job will keep the system in service

By J. H. Shaw
Eastman Kodak Co.

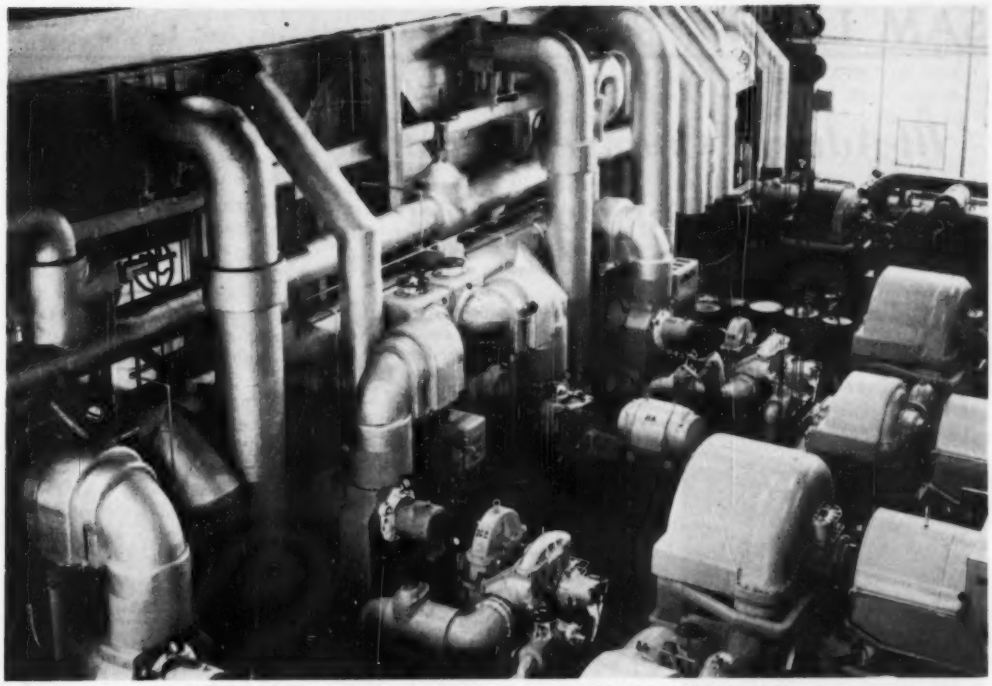
IN THE ARTICLE on figuring the cost of process piping shutdowns published in the November HPAC, the facts surrounding the example given do not seem to me to justify the expenditure of effort made to arrive at a conclusion.

In the example, the battery of kettles is used 6000 hr per year. If it is assumed that the process is conducted on a three-shift, five-day week, or approximately 6000 hr a year, 2760 hours of down-time are available for maintenance, alterations, etc. These down-time hours are presumably weekends and holidays.

The example should take these down-time hours into account for maintenance purposes, and overtime pay (if any) for maintenance labor should be balanced against shutdown during "factory" hours at straight-time labor cost but with production loss included. An emergency or unanticipated shutdown due to valve or pipe line trouble seems extremely remote and unnecessary if the equipment is available for maintenance every weekend.

Most valve troubles are packing failures at valve stems. If the service is critical regarding outages, then back seated valves should be used so that packings can be replaced with the valve in service.

If corrosive or erosive fluids or



THE PIPING AT THE LEFT is carrying fluid at −85 F. This 16 in. and 18 in. piping, up to and including the valves, cannot be shut down without a very considerable production loss

gases are being handled through the valves, then properly engineered valves should be used — keeping in mind material of valve parts, design and pressure rating.

With regular inspections set up by a proper maintenance schedule, it seems doubtful, in the example used, that extra piping and valves can be justified with 2760 hr of downtime a year available for maintenance.

Many Processes Can't Be Shut Down

There are numerous cases in my experience where continuous processes and services are in existence that cannot or are not shut down for periods up to 10 years or longer. For processes of this kind, the power services must be thoroughly engineered with the piping and valve arrangement given careful consideration, including analyses somewhat similar to that outlined in November.

An example of this is a steam line supplying power to the drivers of five 1180 ton refrigeration compressors on critical service, and a second parallel steam line supplying numerous steam drives on brine and water pumps. These two steam lines are connected full size at their far ends and sectionalizing valves are located between each two compressors and between each two to three pump turbines. Such an arrangement has proved invaluable on the very infrequent occasions when partial shutdowns have been necessary for header valve repairs and connections for new lines, etc.

In another critical piping system, handling an alcohol type fluid at very low temperatures, the branch lines to the process units are double valved, with the valve nearest the header intended primarily for emergency shutoff and the second valve located near the process unit used for control. The control and shutoff valves are designed specifically for the use intended, with special alloy parts, long stuffing boxes with special packing, provision for back seating, etc. This piping system is designed for at least 10 years of continuous uninterrupted service and probably will operate much longer before any partial shutdown is required. An unplanned or emergency shutdown of any part or branch of this piping system would involve considerable product loss and in this case extra precautions in the design and construction were easily justified.

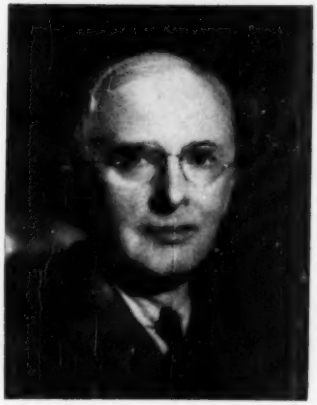
Periodic Inspections Essential

Periodic and regular inspections of all piping systems are essential and repairs should be made where possible with uninterrupted service. Extreme temperature changes in piping systems resulting from shutdowns sometimes cause leaks at flanges, threads and packings that require attention after start-up. For this reason, shutdowns of piping normally operating either hot or cold should be avoided as much as possible.

Forced shutdowns can be reduced considerably by proper initial engineering, use of the correct materials for the service intended, and a good construction job.

SAM LEWIS' PAGE

Ill-Advised Changes Harm Heating Plant Operation



SAMUEL R. LEWIS, consulting mechanical engineer and a member of HPAC's board of consulting and contributing editors, comments informally each month on practical heating, piping and air conditioning problems. He tells the story here of a well-designed heating plant whose operation was very much hampered by ill-advised changes instituted over a period of years

I WAS CALLED IN on a job recently to correct a number of heating difficulties. A summary of what was wrong — and how it got that way — will serve as an example of the sort of thing to avoid if efficient and economical heating of a building is to result.

The project is a very large group of apartment buildings, providing homes in pleasant surroundings for about 800 families. All space heating and domestic hot water come from a central boiler plant. Heat transmission between the buildings is in underground conduits.

The thousands of convectors are heated by mechanically circulated hot water, designed for a mean effective temperature of 220 deg when the outdoor temperature is −10 and the water is capable of being at a reduced temperature as needed. Water in the stoker fired boilers was to be at 240 deg, and was to be blended, near the circulating pumps, with part of the recirculated water so that the outgoing water in weather milder than −10 deg would be at a temperature such that little manual manipulation of the flow valves at the local convectors would be necessary.

Comfort and fuel economy were to be attained by means of an outdoor thermostat at the boiler plant working in connection with a limiting aquastat in the returning water, so as to vary the temperature of the outgoing water in inverse proportion to the outdoor temperature.

Domestic warm water was to be sent out at about 160 deg and to return at about 140 deg. The domestic water was to be heated in heat exchangers — or, to use the term employed in England, calorifiers — by water at 240 deg from the main heating boilers.

In each large building a balanced valve in the flow main of the heating system responded to the pressure in the corresponding return valve of that building in such manner as automatically to pass enough water to maintain a fixed differential pressure. This pressure was sufficient to cause balanced distribution at the average temperature required for that building.

The calorifier for domestic hot water received mechanically circulated boiler water around the outsides of the copper tubes, and the domestic water was circulated through the insides of the four-pass tubes into a large insulated hot water storage tank. Other pumps moved the water from the top of this tank out to the buildings and back to the bottom of the tank.

The operating staff, however, suffered over the years by promotions, age and ignorance — until the following situation developed.

The returning domestic water had been bypassed from the storage tank so that all of it, plus the many additional gallons of make-up water (to replace that used in baths, lavatories and laundries) was forced through the small tubes of the four-pass calorifiers. Little of it ever saw the interior of the storage tank and the rate of flow through the copper tubes increased to about 400 percent of the designed and logical speed. The pumping power naturally increased exorbitantly and erosion of the copper tubes limited the life of most of them to less than four years.

Operating Staff Makes Some Changes

The operating staff concluded that an expansion tank, placed overhead in the boiler plant, was useless. They therefore bypassed it and its air cushion and air compressor (all necessary to provide assured water pressure in the top story convectors of the apartments.)

They concluded also that, instead of maintaining the boiler water temperature at 240 deg, they could save fuel and labor by operating at less than 212 deg. They plugged the system full of water from city mains and tried to get rid of the air that must enter with raw water, by air valves on the hundreds of convectors on the top stories of the buildings. They decided that the automatically controlled blending valves between the returning water and the boiler water were useless, and they kept a man constantly trying to achieve comparable results to those from automatic control, by manual adjusting of the blending.

They gave up trying to keep the aquastats that controlled stoker operation in repair and had a man kick in a stoker or kick it out (as he occasionally observed the thermometer.) Boiler tubes and other ferrous piping commenced to leak, perhaps due to excess gases in the water and to the absence of any cushion against

solid water pressure. The operating head resigned or was fired. His successors received no coherent instructions.

Management First To Blame

When I was called in on the job, I found plenty to criticize.

Management first was to blame, and management has to pay the cost of restoration and repair — though management couldn't agree within itself about having failed to enlist the original competent contractor or a consulting engineer.

The expansion tank and air compressor go back into service. The boiler temperature goes back to 240 deg. The stokers go back to automatic response to the aquastat. The blending valves and thermostat return to automatic operation. The hot water tank gets "un-bypassed" and *it* circulates with the calorifiers. The calorifiers return to a reasonable velocity and have new copper tubes.

When the plant was designed, it was well in advance of its contemporaries. Were I to design a new system for a project like this one, I think I would find little to recommend that would differ from the original design.

I would have a thermostat in each major building to control the water temperature locally, thus achieving some improved zoning. The domestic hot water calorifiers would have the boiler water in the tubes rather than outside them.

I would try to induce management to require at least one annual inspection and report by the contractor or by some other qualified person to make sure that adequate maintenance and intelligent operation would continue.

Church Air Conditioning Solves Many Problems

NEW MATERIALS, technological advances, and new construction methods are producing new church designs and greater comfort for church-goers. One of the most important innovations — especially in the South and Southwest — is the increased use of air conditioning. It is being found that cooled congregations are larger and more active.

The Noel Memorial Methodist church, Shreveport, La., not only fills a previously empty balcony but puts in extra chairs for the overflow. The pastor of the Homer Methodist church, Homer, La., attributes a congregation increase of 10 percent to air conditioning. Other churches report attendance up 15 percent.

Churches below the Mason-Dixon line face a special problem underlined by last summer's skyrocketing mercury. Summertime congregations noticeably dwindle and the heat stifles parish enthusiasm.

Church boards are understandably conservative when it comes to spending their hard-earned income, and air conditioning may sound too "modern" to traditionalists. However, just as people in general are returning to older values and to their churches, so, using the best and newest materials, ideas, and construction to build a church is really a return to the values of another age. The great mediaeval cathedrals were the last word in engineering and construction principles. Only in more recent times did church construction and art solidify into "what was good enough for grandfather."

Besides their beauty of line (adapted to Texas in the lovely University Baptist church at Fort Worth), the gothic cathedrals have the advantage of being cool in summer — an advantage most churchgoers from Florida to Oklahoma must have envied during the blistering heat of the past summer.

Massive construction cools the cathedrals. Our smaller, more economically built churches must keep cool artificially. For instance, the University Baptist church not only adapted the gothic line to Texas surroundings; the Rev. W. Ray Watson and his congregation also adopted air conditioning to beat Texas heat.

They used compact self contained air conditioners totaling 18½ hp. Because peak demand is placed on the air conditioning equipment only for the limited time services are held, because the congregation is quiet and there is no smoking; and because the auditorium can be pre-cooled, surprisingly "light" equipment is required to air condition even a large church, according to York Corp. engineers. "Stratified cooling" is employed by conditioning only the bottom layer of air to just above the congregation's heads. Operating expenses are reduced by cooling only that part of the church in use at a given time.

The concealed cooling tower (located inside the building above the machinery room) and the inconspicuous louvers through which outdoor air enters do not interfere with the architectural lines.

An important byproduct of air conditioning is the reduced cleaning and decorating bills.

The really important results aren't measurable solely in dollars and cents. The Rev. Mr. Watson says "I personally did not realize the importance of air conditioning in churches until we experienced this past unusually hot summer." Attendance for services and Sunday school activities increased over 50 percent and the general membership went up 35 percent. Interest in various other church activities sharpened. The Rev. Mr. Watson feels that air conditioning had a direct bearing on this. His church members are interested in holding more and more church functions in the new air conditioned auditorium and their enthusiasm is spreading to the less-regular members.

Other ministers find much the same thing. Their congregations increase or — and with outdoor temperatures reaching for 100, this is no small feat — show no summer decline. Congregations are more attentive when restless street noises are shut out and there is no need to fan or surreptitiously wipe beaded brows.

Ministers are particularly grateful for the stepped-up interest in parish work, more regular attendance at choir practice, and generally increased enthusiasm. A lot of people who will go to church for the good of their souls need the encouragement of a little comfort and more invigorating temperatures to go to work for the good of their parish.

QUESTION OF THE MONTH

What's the Right Method for Supporting Insulated Piping?

I APPRECIATE the remarks by Marshall F. Allen in the November HPAC in answer to my query on the application of insulation on low pressure steam and hot water piping. Mr. Allen's answer to my question describes a method used to cover main steam lines in a large installation and is most interesting, but I am trying to find out if it is better to use a comparatively cheap method of insulating moderate temperature lines and take the heat loss — or if it pays to spend more money for pipe covering and save the heat loss. In other words, what is the economic balance between a higher initial cost of installation and the savings in steam and longer life of the covering after a period of five years has elapsed?

For the kind of piping I am talking about, the method mentioned in the second paragraph of Mr. Allen's article seems to be generally used. The sectional insulation is cut off at the ring or clevis, the bare pipe is laid therein, and plastic or moldable insulation is applied to both the pipe and ring. The amount of heat loss with this method probably varies with each individual application and so does the life of the insulation at this point.

With power piping and similar work, the covering and supporting of the high pressure, high temperature piping is an exact science and is covered in the specifications as such. This is not the case, however, in much other piping work, including heating systems for commercial and industrial buildings and the like. Many of the specifications for hanging and covering the piping of such systems are expressed in generalities and the sum and substance of them is that they give the contractor practically a free hand to install as he pleases — especially in hanging and anchoring. The specification writer in most cases does not know how the pipe will be supported until he sees the finished installation — or what is more likely, he never knows about it or sees it.

Many contractors, of course, do an excellent job in this regard and turn out a good, finished job regardless of inadequate specifications. Some do not. Just the other day I went through a large industrial building, which was almost finished. The heating and hot water piping was covered with 1 in. of air cell. The horizontal lines, some of them of fairly large size, were hung in rings and clevis hangers, but the insulation was not cut off at each point of support. Instead, the whole length of piping was evidently covered with a continuous run of insulation and then the covered pipe was placed in the rings or clevises. The heavy weight of the whole line rested on the 1 in. of air cell. Certainly this insulation is not going to stand up too long.

This is only one case, but I'll wager there are hundreds of others. If there is a heat loss or if the insulation wears out three times as fast as it should, very few people are around to bother about it.

These things prompted my original question: Where is the balance between low initial cost of this work and the savings to be obtained by long life and little deterioration of the insulation by spending more money on the original installation?

While I am on this subject, another question on the installation of low pressure piping comes to mind which is ignored in too many specifications. That is, What is the most practical type of support for such piping which is low in initial cost, will permit the pipe to move freely in response to thermal expansion and which causes the least wear on the insulation? In such installations, horizontal piping may move a couple of inches per hundred feet. With the piping laid in ring or clevis hangers, it is pretty rigidly anchored to the hanger and hanger rod. How is the best way to allow for longitudinal pipe movement? Should the rod be rigidly attached to the building structure and made long enough so that the natural "spring" in the length of rod allows for lateral movement, or should the hanger rod be so attached that a slight amount of lateral swing is always possible? With the "spring" method, there is the old rule-of-thumb to allow 1 ft of hanger length per inch of expansion expected in the run of line. I do not know the origin of this rule, but it is probably not too far off. If the second of the two above mentioned methods is to be used, should beam clamps be used instead of concrete inserts?

I believe a beam clamp affords a more practical way of attaching the rod and permitting lateral swing than does an insert. Should roller supports be used, instead of rings or clevis hangers? With rollers, how much quicker will the insulation deteriorate if protection saddles are not used?

In an earlier article, I read that in the installation mentioned by Mr. Allen, it was found that the roller supports were not revolving as the pipe moved. The covered pipe was simply sliding over the roller. If things like that can happen on a job of such magnitude, what is happening on hundreds and hundreds of piping installations not so carefully designed?

Are there any facts or figures available which will help the average specification writer — who usually hasn't the time to spend on such items and who seldom has the opportunity to check his work after it is installed — to do a better job for himself and for his client when it comes to this matter of the right way to support insulated piping?— H.P.R.

RADIANT HEATING INSTITUTE SEEKS IDEAS ON PROPER DESIGN, INSTALLATION

If you don't have the answer to a problem, chances are someone else does — or can be helpful on part of it. That's the purpose of HPAC's Question of the Month "idea exchange," where questions on heating, piping and air conditioning are asked and answered.

You are invited to contribute a question for publication, or an answer to a published question. . . . . Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

We devote this space this month to some questions about radiant heating.

THE RADIANT HEATING Institute of California — an organization sponsored by engineers, architects, contractors, supply houses, manufacturers and sales agents — is surveying certain installation problems, invites discussion of them, and plans to make recommedations on design and installation procedure.

Many radiant heating system boilers are fired and controlled at the water temperature required for the radiant heating coils. This results in far too low a boiler temperature, causing sweating, etc. on gas fired jobs, and a very difficult combustion condition with oil, a committee appointed by the institute says. The committee feels that boilers should be carried at not less than 180 deg control temperature, the water to the radiant coils being supplied through a three-way thermostatic control valve.

Many contractors and some engineers size pumps far beyond the capacity required, says the committee, so that there is very little temperature rise through the boiler. This also causes combustion condensation and defeats the natural boiler circulation. The committee feels that there should be not less than a 20 deg rise through the boiler.

On many installations — says the committee — the heating system is not boiled out, flushed out or cleaned, with the result that after heat is applied and grease, dirt and oil are liberated from the equipment, a very definite acid condition is created. This acid condition — along with too large pumps — creates an entrained oxygen condition which becomes extremely corrosive. This corrosion attacks the entire system and finally the boiler and controls are loaded with muck. The boiler develops hot spots, etc., and some serious conditions have been the result. Most mechanical engineers and school boards now call for and demand proper cleaning, etc.

A properly sized pump, temperature in boiler and three-way thermostatic valve, plus proper cleaning, seem to be the answers to the committee.

The committee would welcome comment on the following:

a) Boiler temperatures required for good combustion and circulation within the boiler.

b) Sizing of pumps for proper temperature rise through the boiler, should three-way thermostatic valves be employed on installations, to insure proper boiler operation.

c) The importance of cleaning the heating system of foreign matter to insure proper action of boiler, pump and controls, and to eliminate corrosion within the system.

d) Proper installation of boiler piping to insure proper air venting of system. Waterlogged expansion tanks are often encountered and are uncalled for.

e) Many expansion tanks are too small.

f) What method is recommended for sizing radiant heating systems?

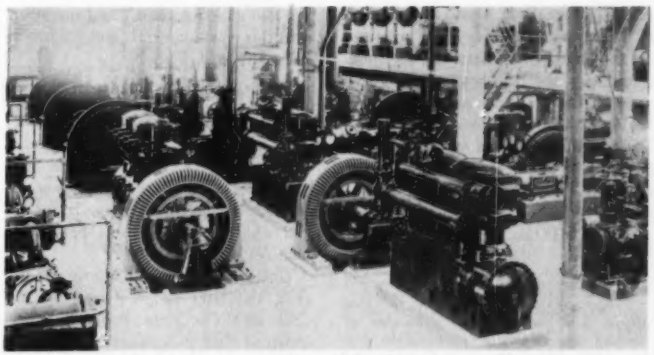
g) Some manufacturers are cataloging one size of relief valve for each size of boiler, with the result that a boiler may end up with one 2 in. relief valve. When this relief valve pops it takes all of the water out of the boiler, the result being a broken and burnt-up boiler. What are recommendations to correct this?

Comment on these points will be welcomed. Address the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, for forwarding to the Radiant Heating Institute's committee.

MARKS 100TH ANNIVERSARY NEXT YEAR

THE FRICK CO., Waynesboro, Pa., will celebrate its 100th anniversary in 1953, and to mark the occasion is publishing a centennial history (available at $1 a copy) illustrated with 200 photos, drawings and documents.

George Frick, the company's founder, started as a millwright in the 1840's, then built steam engines and threshers, and by the 1870's was making sawmills. Today, the company is internationally known for its refrigerating and air conditioning equipment (such as that shown in the photo), as well as for power farming and sawmill machinery.



6420 HP of refrigeration manufactured by the 100 year old company is used by the Celanese Corp. in its plant near Cumberland, Md. Air conditioning is done with 0.7 hp per ton

Know What Fraud Is To Avoid Money Loss

TO AVOID MONEY loss, it is of the utmost importance to understand precisely what constitutes fraud under the law. The following case (in which the names are disguised) should be carefully read. Had the victim been acquainted with the pitfalls and alert in his own behalf he would have avoided a four-figure loss, with court costs in addition — not to speak of the lawyers' fees.

Peter Planderbilt, general contractor, signed up with Hamm & Hominy for the construction of a general market on a well traveled street. Planderbilt in turn gave a subcontract to G. O. Therm, Inc., for installing a heating and air conditioning system in the building.

That was on June 1. Therm completed the job six months after accepting the subcontract. He had received $600 five days after such acceptance, but no further payments.

General Contractor Goes Into Bankruptcy

Without including G. O. Therm as one of the subcontractors, the general contractor signed a sworn statement on October 13 to the effect that he had "not employed or procured materials from or subcontracted any person other than those set forth" in that statement for the erection of the building. Because of such statement, the mortgage funds — applied for by the owners of the building — were released and disbursed to Planderbilt in the sum of $19,000. No part of this was paid to G. O. Therm. The hapless subcontractor was left in the dark and pursued his task to completion in November.

On the following January 8, the general contractor (as might have been expected after such actings and doings) went into bankruptcy and in due course received his discharge. Although the bankruptcy proceedings listed an indebtedness to G. O. Therm, that person did not learn of the sworn statement omitting all mention of such indebtedness until February 3.

Therm brought suit against Planderbilt, alleging fraud. The subcontractor declared that the general contractor "did willfully and fraudulently and with intent to defraud" furnish a false sworn statement, thereby effecting release of monies from the bank, and did in "absolute fraud . . . appropriate said monies" belonging to G. O. Therm.

Therm further declared that Planderbilt had "acknowledged the said fraudulent action" at a hearing before the bankruptcy court on February 18. Therm averred that Planderbilt had admitted on cross examination that he had not listed G. O. Therm, Inc., as a creditor in his sworn statement. He had given no explanation as to why he had signed such a statement or sworn to such an omission "when he well knew" that the subcontractor "had not been paid for the material and labor in question."

Therm's Case Would Seem To Be Perfect

To the casual observer, it would seem that G. O. Therm's case was about perfect. As everyone knows, bankruptcy does not erase fraud — and was not Planderbilt's behaviour manifestly fraudulent?

Unfortunately for Therm, however, the trial judge threw out the case and the state supreme court affirmed that judgment. Planderbilt relied upon his discharge in bankruptcy as a defense. This defense was sustained, not by reason of the general contractor's guilt or innocence but because Therm had failed to show *actionable* fraud.

Planderbilt's sworn statement was given on October 13, approximately 30 days before G. O. Therm finished the heating and air conditioning installation. Therm, as heretofore noted, did not learn of the sworn statement until February 3. Therefore, reasoned the supreme court, the giving of the sworn statement in no way *influenced* the subcontractor — who "failed to make out a case" of *actionable* fraud against himself.

Why Heating Contractor Did Not Win

Citing an earlier opinion from the same bench, the court defined the elements of actionable fraud. Reduced to layman's language, it must be clear: (1) that the person accused made a material representation; (2) that it was false; (3) that when he made it he knew it was false or he made it recklessly without any knowledge of its truth and as a positive assertion; (4) that he made the statement intending for the other party to act upon it; (5) that the other party acted in reliance thereupon; (6) and that the other party thereby suffered injury. Each of these conditions must be proved with a reasonable degree of certainty. *All* of them must be found to exist; the absence of any *one* of them is *fatal to recovery.*

"It does not appear," commented the court, "that the giving of the sworn statement in any way influenced the plaintiff" G. O. Therm *either* "in the completion of his work" *or* in the "extension of credit."

G. O. Therm's defeat stemmed from his failure to establish items (4), (5) and (6) respecting his case. This failure in turn was clearly traceable to Therm's own neglect. Had he kept himself currently informed regarding the general contractor's movements, he would have learned of the sworn statement and been governed accordingly.

[Note: While this discussion applies to an actual case, it should be remembered that legal rules vary in different states.]

William Hurd Hillyer, author of this article, is a contributor to a number of banking and financial publications and has written several books on business. A former vice president of the Atlanta Trust Co., his work there gave him a practical legal background.

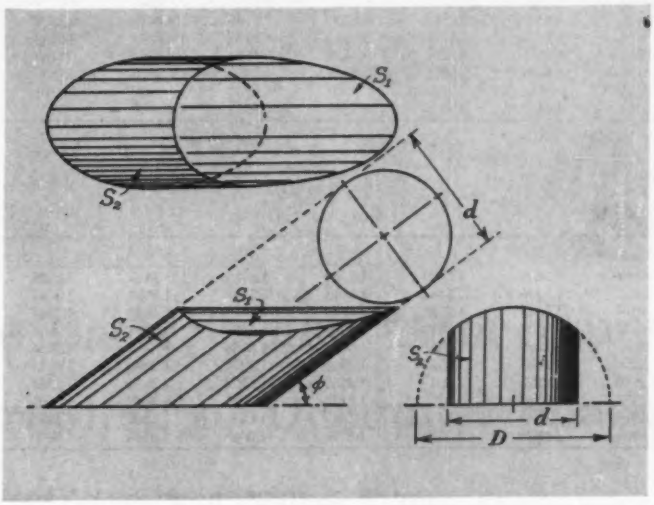


FIG. 1 — HOW TO DETERMINE the areas intercepted upon each other by two cylinders of different diameters whose axes intersect at an angle is explained here

Determining Weights of Piping Assemblies

(Areas of Cylindrical Intersections)

By John E. Brock, Director of Research, Midwest Piping & Supply Co. Inc.

IN DETERMINING weights of piping and other assemblies fabricated from thin sheet or plate, it is sometimes necessary to determine the areas intercepted upon each other by two cylinders of differing diameters d and D whose axes intersect at an angle ϕ.

The smaller cylinder intercepts upon the surface of the larger two egg-shaped areas, one of which is shown in Fig. 1 and is designated by the symbol S_1. The larger cylinder intercepts upon the surface of the smaller cylinder a cylindrical area with curved ends, one half of which is shown in Fig. 1 and is designated by the symbol S_2. Their areas are:

$$A_1 = \text{Area of } S_1 = fd^2/\sin\phi$$

$$A_2 = \text{Area of } S_2 = gdD/\sin\phi$$

where f and g depend upon the value of a parameter $m = (d/D)^2$.

Values of f and g are given in the accompanying tables for m = 0,0.01,0.02, ...0.99; for example, if $m = 0.27$, then $f = 0.8150$ and $g = 1.4587$. Values for $m = 1.00$ are not given in the table; they are $f = 1.0000$ and $g = 1.0000$. Interpolation may be used to get values

VALUES of f

m	0	1	2	3	4	5	6	7	8	9
0.0	0.7854	0.7863	0.7874	0.7884	0.7894	0.7904	0.7914	0.7924	0.7935	0.7945
0.1	0.7956	0.7967	0.7977	0.7989	0.7999	0.8011	0.8021	0.8031	0.8044	0.8055
0.2	0.8067	0.8078	0.8090	0.8102	0.8114	0.8125	0.8138	0.8150	0.8163	0.8175
0.3	0.8188	0.8201	0.8214	0.8227	0.8240	0.8253	0.8267	0.8279	0.8294	0.8307
0.4	0.8322	0.8336	0.8350	0.8365	0.8380	0.8395	0.8410	0.8426	0.8441	0.8456
0.5	0.8472	0.8488	0.8504	0.8521	0.8537	0.8554	0.8571	0.8589	0.8607	0.8625
0.6	0.8644	0.8662	0.8681	0.8700	0.8719	0.8739	0.8760	0.8780	0.8801	0.8821
0.7	0.8844	0.8866	0.8888	0.8911	0.8935	0.8959	0.8983	0.9009	0.9034	0.9061
0.8	0.9088	0.9115	0.9144	0.9174	0.9205	0.9236	0.9268	0.9301	0.9336	0.9373
0.9	0.9411	0.9451	0.9492	0.9536	0.9583	0.9632	0.9686	0.9745	0.9811	0.9889

Example: For $m = 0.27$, $f = 0.8150$.

VALUES of g

m	0	1	2	3	4	5	6	7	8	9
0.0	1.5708	1.5669	1.5629	1.5589	1.5550	1.5510	1.5470	1.5429	1.5389	1.5348
0.1	1.5308	1.5267	1.5226	1.5184	1.5143	1.5101	1.5059	1.5017	1.4975	1.4933
0.2	1.4890	1.4848	1.4805	1.4762	1.4718	1.4675	1.4631	1.4587	1.4543	1.4498
0.3	1.4454	1.4409	1.4364	1.4318	1.4273	1.4227	1.4181	1.4134	1.4088	1.4041
0.4	1.3994	1.3947	1.3899	1.3851	1.3803	1.3754	1.3705	1.3656	1.3606	1.3557
0.5	1.3506	1.3456	1.3405	1.3354	1.3302	1.3250	1.3198	1.3145	1.3092	1.3038
0.6	1.2984	1.2930	1.2875	1.2819	1.2763	1.2707	1.2650	1.2593	1.2534	1.2476
0.7	1.2417	1.2357	1.2296	1.2235	1.2173	1.2111	1.2047	1.1983	1.1918	1.1852
0.8	1.1785	1.1717	1.1648	1.1578	1.1507	1.1434	1.1360	1.1285	1.1207	1.1129
0.9	1.1048	1.0965	1.0879	1.0791	1.0700	1.0605	1.0505	1.0399	1.0286	1.0160

Example: For $m = 0.27$, $g = 1.4587$.

of f and g corresponding to values of m which are not in even hundredths.

Example Shows Use of Method

As an example of the use of these formulas, consider determining the weight of a 45° lateral where the run length is L of pipe having mean diameter D and weighing w_1 pounds per inch, and the branch length is U of pipe having mean diameter d and weighing w_2 pounds per inch. The weights of the respective portions are

$$W_1 = w_1 L(1 - A_1/\pi\, DL) = w_1(L - fmD/\pi \sin 45^\circ)$$
$$W_2 = w_2 U(1 - A_2/\pi\, dU) = w_2(U - gD/\pi \sin 45^\circ)$$

Thus, for a 10 in. on 12 in. 45° standard weight carbon steel lateral with center-to-end dimensions as shown in Fig. 2, we have $D = 12.750 - 0.375 = 12.375$; $d = 10.750 - 0.365 = 10.385$; $m = 0.7042$; $f = 0.8853$; $g = 1.2392$; $\sin 45^\circ = 0.70711$; $D/\pi \sin 45^\circ = 5.5707$; $w_1 = 4.130$ pounds per inch; $w_2 = 3.373$ pounds per inch.

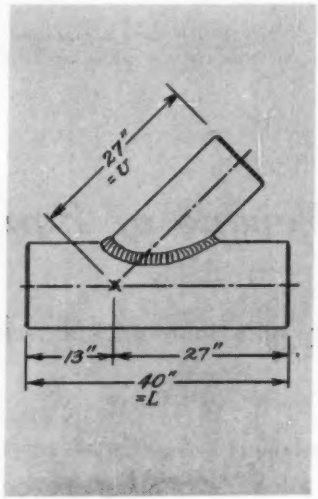


FIG. 2 — EXAMPLE OF USE of the method explained is given for this 10 in. on 12 in. 45° lateral

Substituting, we find $W_1 = 150.86$ pounds and $W_2 = 67.79$ pounds. The additional weight of the weld deposit and allowance for the loss in weight due to machining the welding bevels at the ends amount to an additive factor of about 11 pounds. The total is 229.65 pounds and the probable errors in the basic data require rounding off to 230 pounds.

Heating, Piping & Air Conditioning

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

JOURNAL SECTION

The Bacteria and Odor Control Problem in Occupied Spaces

By R. L. Kuehner*, York, Pa.

SUMMARY — Results of 9 years research into odor and bacteria control principles are presented. The ignorance of these principles, by preventing a common baseline of correlating knowledge, has handicapped progress to such an extent that there have been no methods by which the merit of air sanitizing agents can be factually evaluated.

Basic techniques whereby bacteria and odor control work can be conducted in an engineering manner are described. It is shown that the fundamental nature of experimental results secured by these techniques presents to the air conditioning industry a yardstick for the furtherance of research in air sanitation and for a uniform evaluation of the results of such work.

Purpose

CONSISTENT PROGRESS toward the solution of the problems of air sanitation has been confounded by recent frantic, and in many cases, haphazard efforts to satisfy the consuming public. This is illustrated by the number of products parading under the badge of bacteria and odor *removers*. Extensive experimental work has been undertaken toward an understanding of the basic problems of air sanitation. The results permit the interim formulation of recommendations concerning bacteria and odor control which will better direct the efforts of the researcher and permit the understanding of the layman.

This discussion applies to the absolute removal and destruction of bacteria and odor, not to the masking or neutralizing of odors or reducing the sensitivity of the olfactory sense.

Introduction

The term, *air sanitation*, is borrowed from Dalla Valle[1]. While his interpretation appears to limit its meaning primarily to dust control, and secondarily to bacteria and odor control, this term in its literal sense should be a basic division identified with air conditioning. Air conditioning has meant, too often, simple cooling and dehumidification of air. The future demands that this industry assume the responsibility for air conditioning in its broadest sense. How much this will entail only can be guessed, since there is no full understanding of the finite differences between *country fresh* and *vitiated stale* air. By concerted effort, the standards of temperature, relative humidity, and air motion have been set and become the basis of air conditioning practice. By the same concerted effort, sanitation qualities must be standardized before claim can be made to truly conditioned air. Whether these qualities are the poisons in expired breath mentioned by Hammond[2], the anaphylactic protein of Rosenau and Amoss[3], the ions of Dessauer[4] and Yaglou[5], or as yet unknown factors, the production of truly conditioned air is the obligation of this industry to society. A man consumes daily, pound for pound, several times more air than food, and 10 times as much air as water[6]. Does not the air man breathes deserve the same quality control as his food and water?

Over and beyond this altruistic obligation is the practical side. Until a satisfactory air sanitation means is found, the industry is faced with the penalty of outside air required to preserve decent indoor conditions. U.S. Naval research[7] has established

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[1]Exponent numerals refer to Bibliography.

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that only one cfm outside air per person is necessary, to maintain proper oxygen and CO_2 levels, yet 20-30 cfm outside air per person is common practice for ventilation purposes. Consider the reduction in first cost and operating cost when an air sanitizer is substituted for outside air. While research is progressing to define the suspected components and discover unknown components of air quality, it is only in bacteria and odor control that the problems are sufficiently recognized, and progress sufficiently great, to make a real contribution in this field.

It is beyond the scope of this paper to trace the history of bacteria and odor control. Nor is it intended to assay the worth, or lack thereof, of literature in this field. Interest in air-borne bacteria dates from the work of Louis Pasteur around 1860. Interest in odor dates from man's creation. Odors and Sense of Smell[8] cites references back to 320 B.C. in a 300-page bibliography. The thousands of pieces of literature are more descriptively presented than could be done here in such texts as those by Moulton[9], McCord[10], Medical Research Council[11], Rosebury[12], Crocker[13], and Moncrieff[14].

Yet with all this interest and knowledge there is no universally accepted air sanitizing agent. A great handicap, recognized by Gerhardt[15] in 1928 and by Crocker[16] in 1935, has been the lack of a common working language. This is only a symptom. There has been no complete study of the nature, cause and effect of bacteria and odor in enclosed spaces. For example, it is recognized by all that the spread of infection via the air is potentially a great threat, increasing as more and more people are brought in close contact and the same air is delivered from person to person. Since no one can say at what point air is safe or harmless, the penalty of outside air must be continued because there is no yardstick to measure a substitute method. Odor, while not physiologically harmful, is more tangibly objectionable. Because their nature, their rate of production, their maximum tolerable levels and necessary rates of removal are unknown, there is no satisfactory progress toward their control.

It was with the goal of developing an acceptable baseline of understanding that this work was undertaken. In so doing it was necessary to establish, in a broad sense, those air components concerned and to define the degree of removal of these components required. This obviously demands methods of measuring these components, not in past terms of good or bad, pleasant or unpleasant, but in finite numbers. It demands the removal of opinion. Only by so doing can the researcher evaluate his progress, the producer know what he is selling and the consumer know what he is buying. Odor and bacteria control has become a highly competitive field but one in which the competition remains in the realm of adjectives to such an extent that the air conditioning industry could not now by any single criterion, or group of criteria, determine which deodorant or disinfectant is better than the other, or if any have merit at all.

Odor

Experimental Procedure: In 1946[17] literature was presented to establish that odors are specific chemical substances of fat soluble and certain minimum vapor pressure characteristics. The first conclusion drawn is the finite nature and indefinite effects of odors. While it is possible to find and identify a specific chemical substance of certain consistent physical characteristics at the root of every odor, it has been impossible to conclude why the sense of smell is stimulated and, accordingly, impossible to formulate any generalization as to odor types and methods for their destruction.

If odors were of a specific chemical type and their behavior patterns followed this chemical type, it would be simple to undertake odor problems on the basis of individual odorous chemicals. However, investigation has shown that because a given chemical or mechanism is deodorant toward any single odor, it need not be deodorant toward naturally occurring odors which are aggregates of many individual odors. In the laboratory, a deodorant was developed using butyl mercaptan as the test odor. When this deodorant was checked in a practical system with tobacco smoke, without fresh air, it was found that while the mercaptans present in tobacco disappeared the system became foul because of the build up of the other odorous components which the deodorant would not attack. The deodorant was specific for mercaptans. Because the same specificity occurs if one uses odorous acids, bases, alcohols, aldehydes or others as test odors it becomes impossible to use any synthetic odor as characteristic of naturally occurring odors except in those rare cases, such as egg rooms, where one specific odor is the offender.

Therefore, any test work must be done on naturally occurring odors. Tobacco odor and body odor were considered the most troublesome in air conditioning. Because both of these are aggregates of many odors, unknown to a great extent, a chemical means of measuring their concentration seemed remote.

Dilution Measurement: Since all work on the removal of odors must, in the final analysis be put in terms of human sensibilities, attention was directed toward a *dilution-threshold* method. Because the olfactory threshold is the minimum concentration of an odor which can be smelled and because increases in concentration above this minimum cannot be evaluated by the unaided nose, this technique reduces all odorous air to threshold values. By mixing sufficient purified air to a measured quantity of odorous air, the odor present in the mixture is reduced to threshold. The ratio of the dilution air, odorous air mixture to the odorous air is referred to as the number of thresholds of a given odor present.

This apparatus employs the same principle used in the Camera Inodorata by Zwaardemaker[18] and in the commercial Osmoscope by Fair and Wells.[19]. Various other instruments of the same type[20-24] have found application in the perfumery, water supply and sewage disposal industries. Upon the advice of E. R. Weaver of the National Bureau of Standards,

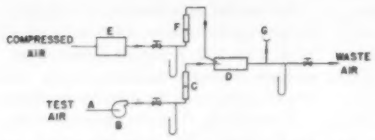

Fig. 1—Dilution system to measure thresholds

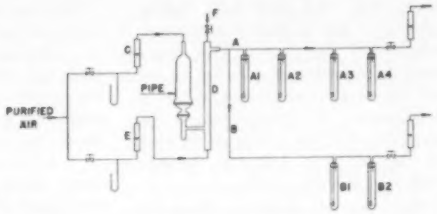

Fig. 2—Absorption system used in chemical measurement of odors

an instrument (see Fig. 1) was designed, modifying this principle for use in practical odor measurement.

In Fig. 1, the odorous air is drawn from test area through tubing A by blower B. This air quantity is measured by rotameter C. The odorous air passes to mixing chamber D where it is mixed with the purified dilution air. Dilution air is supplied by passing compressed air through a purifying train E for removing impurities[17]. This air is then measured by rotameter F before entering mixing chamber D. The air mixture is discharged at sampling orifice G. The operator records the air flows at which the odor is just detectable at G. By proper balancing of air flows, this presents a method of reducing any concentrations of odor to terms of thresholds. For example, if 2 cfm of purified air mixed with 1 cfm odorous air renders the odor barely detectable, the odor in the original air was at a concentration of 3 thresholds.

Because of its dependence upon the acuity of the olfactory sense, this technique, uncontrolled, would be open to question from two angles. First, since the sensory sensitivity may vary within an individual from time to time, comparable odor measurements could not be taken by a given operator over prolonged periods of time. Second, the odor levels taken by one worker do not necessarily compare with those of another.

In the first case, standardizing of the operator, two techniques have been devised. In surveying a large group of operators for this work, while extreme variation in individual sensitivity was found, two operators were found to have practically identical sensitivities to tobacco odors, cooking odors, and certain synthetic odors. Since it is unlikely that two individuals' sensory perception would vary simultaneously from physiological causes, two such operators served as a control for each other. During test runs, when the readings of the two coincided, the data were considered valid; when the readings were divergent, the data were discarded. It was found that in almost 100 percent of such readings over a four-year period, the two operators confirmed each other so that reports of variation of the human sense of smell appear to be exaggerated.

Where two controlling operators are unavailable, another technique was found suitable for establishing absolute baseline of sensitivity. This involves the dilution measurement of a constant known odor to determine the percent efficiency of the nose at any time during a series of experiments. In an air-tight container, xylene was permitted to permeate the air to saturation under controlled temperature and pressure conditions. In a prolonged series of experiments, the normal odor level of xylene was found to be 380 thresholds. If, on a given day, an operator found xylene threshold values greater or less than 380, his percent efficiency could be calculated and his test data corrected accordingly. Divergent readings of two operators can be corrected in a similar manner.

Physical Measurement: Physical measurement of odors has been attempted by various light absorption instruments. None of these were sufficiently sensitive to indicate odor concentration.

Chemical Measurement: It was found that certain oxidants react with odor complexes in a reproducible manner. One in particular was completely interreactible with tobacco and cooking odors. During this reaction, the oxidant is reduced and the odors destroyed. The amount of reduction is measurable and directly proportional to the quantity of odor destroyed.

Three major systems were used in the chemical study of tobacco smoke characteristics. While in earlier studies, these systems were distinct and separate, their principles are discussed in terms of Fig. 2, which is a composite of all three.

In the first studies, tobacco was burned in the pipe in the presence of purified air at various flow rates measured by rotameter C. All of the tobacco smoke passed through the mixing chamber D and absorption train A, train B being eliminated from the system by valves. (The absorption trains are a series of 1-5 tubes, each tube containing an oxidant with which the odorous air is brought in intimate contact by gas dispersion tips). The results were recorded in terms of quantity of oxidant reduced per weight of tobacco burned. When studying the effects of dilution on tobacco odor, quantities of purified air, measured by rotameter E, were passed into the mixing chamber D, together with odorous air from the pipe. Portions of this air passed through train A and the remainder was discharged to waste F.

For measuring deodorant abilities equal portions of diluted odorous air were distributed to each of the two trains, A and B. In train B the odorous air passed directly into two tubes, B-1 and B-2, containing the oxidant for measuring the quantity of odor present in the original air. In train A the odorous air passed through the deodorant mechanism

under test (A-1 and A-2) before passing to the oxidant measurement tubes (A-3 and A-4). This measured the quantity of odor left in the air stream after subjecting it to the deodorant. A comparison of the quantity of oxidant reduced in each of the two legs indicated the efficiency of the deodorant.

Experimental Results: With the development of means of measuring basic deodorant ability (oxidant absorption), and evaluating practical results (dilution threshold system) the way is clear for a standard evaluation of air deodorants. By these techniques and toward this goal certain essential fundamental knowledge has been gained.

Using the oxidant train, quantitative measurements of the odorous components of tobacco smoke were determined (Table 1). In these tests, four rates of combustion were used; the slowest approximating the smouldering rate and the most rapid approximating the puffing rate of natural smoking. In conditions 1 and 2 all of the odor produced by the complete burning of the cigarette was collected in the absorption train. In conditions 3 and 4 the odorous air was diluted 30 times by purified air and only 1/100 of the total mixture passed through the absorption train. In these tests various quantities of name cigarettes, both fresh and stale, were used.

In all cases the results were strikingly similar as recorded in Table 1 which is a composite of 200 tests. There is close uniformity in odor production by cigarette tobacco regardless of brand, degree of freshness, rate of combustion and this holds true even with extreme dilution of the odor. Artificial burning of tobacco, because it is reproducible, can therefore be used as a laboratory tool in the investigating of odors; and the variables mentioned which would be expected in human smoking need not be considered as interfering variables. In comparing mechanical with human smoking in normal office spaces, it was found that a certain constant correction factor must be used because of the absorption of the odor in the respiratory tract.

This technique permits the laboratory determination of the efficiency of a deodorant against mechanically produced tobacco smoke odor. By the proper chemical analyses and the correction factors the quantity of the deodorant consumed, hence the cost of a deodorant process, can be predicted in a practical installation on the basis of anticipated amount of smoking.

The simple knowledge of the total quantity of deodorant necessary to remove completely a given quantity of odor is not sufficient. It involves the balancing of production of odor against the removal of odor by the deodorant. This will vary with the contact of the odorous air with the deodorant, the rate of odor production, and the odor levels involved.

Table 1—Quantity of Oxidant Reduced by the Vapors of Burning Tobacco

Condition	Burning Time 1 cigarette Min.	ml N/10 Oxidant Reduced per gram Tobacco Burned
1. Total Absorption	15	120
2. Total Absorption	35	125
3. Dilution Partial Sampling	18	118
4. Dilution Partial Sampling	0.5-1	117

To explore this it was necessary to work with actual smokers in normal rooms. Using four smokers at a controlled rate of smoking without fresh air makeup or a deodorant mechanism, the odor in the test room builds up in regular steps to intolerable levels. This odor gradually built up to a maximum of 14 thresholds. There is a distinct relationship between quantity of odor produced per cubic foot of air and threshold.

In this test it was found that a group of assorted subjects, smokers and non-smokers, recorded the room as immediately objectionable when concentrations of 2.5 to 3.5 thresholds were reached. In a room maintained at 2.0 thresholds, a similar group of subjects reported the condition distinctly bad after prolonged exposure. It has been established the tobacco odor in any room should be held at or below 1.3 thresholds.

Successful deodorization experiments demonstrating these principles have been run in recirculating type systems wherein odorous air is removed from a room, passed through a deodorizing chamber, and returned to the room. The principle is one of dilution as in standard air conditioning, substituting the deodorant for the outside air makeup. Just as in normal ventilation, when any odor source (burning tobacco) is present, it is impossible to prevent the odor from being detected no matter how rapid the recirculation. The objective is rather to prevent this odor from exceeding the objectionable level. To do this the odor must be removed at the same rate as it is produced. Since the only odor which can be removed is that which is carried to the deodorant by the recirculating air, the quantity of this air, the concentration of odor in it, and the ability of the deodorant to reduce this odor are all contributing factors to the efficiency of a deodorant installation.

This is illustrated by a series of experiments run in a test office space. The occupancy was four men, each smoking one-half pack cigarettes per 8-hour day, or 3.3 gm tobacco per hour (mechanical smoking was also used). Within less than 1 hour, the threshold would rise to objectionable levels of 1.9 thresholds; exceeding the desirable 1.3. Once the threshold level had reached 1.3, odor had to be removed from the air at the rate of 3.3 gms tobacco burned odor per hour. Since the only odor which could be removed was that carried to the deodorant at a concentration of 1.3 thresholds, the quantity of air to be recirculated depended upon the efficiency of the deodorant. It was impossible to find a 100 percent efficient deodorant, but substituting outside air for a deodorant (equivalent to a reduction of 1.3 to 0 per pass), the outside air required was 42 cfm. In pursuing these tests with deodorants less than 100 percent efficient, one which would reduce the odor level in recirculated air from 1.3 to 0.5 thresholds per pass through the deodorant would require the recirculation of 69 cfm and one reduc-

ing from 1.3 to 0.7 would require 90 cfm.

By knowing occupancy, smoking rate, and deodorant efficiency, the specifications for any size installation can be predicted.

Bacteria

Experimental Procedure: The degree of importance of air-borne infection is still unestablished in the long term contention between *air-borne* and *contact infection*[23]. A realistic view must be taken in the establishing of logical requirements.

There is ample evidence as to the existence of air-borne infection[9,11] as summarized in any bacteriological text. Since the possibility of air-borne infection is dependent upon the number and virulence of the infecting organism and the state of health of the host, it is impossible, with current knowledge, to set any numerical limit above which infection will occur and below which infection will not occur. Therefore, while standards of the nature used in water and milk remain for the future, an interim standard is recommended.

Current ventilating practice is based on the premise of using quantities of outside air as a means of keeping inside air sanitarily acceptable. Such a procedure presumes that, because of confinement, increase of bacteria within an enclosed space will increase the likelihood of infection. Also, because outside air is relatively free of infecting organisms, ventilation can, by dilution, reduce the likelihood of infection. Therefore, it has been accepted that outside air is desirable and inside air is less so, without any knowledge of degree. The goal to be attained is the rendering of inside bad air comparable to outside good air. Because, in general, the total bacteria counts of inside air are much higher than those of ideal outside air and because of the lack of knowledge as to the comparative numbers of pathogenic bacteria, inside and out, total bacteria counts become the yardstick.

For an air sanitizing agent to have merit, it must reduce inside total bacteria counts to concentrations approaching outside counts. Because there is no constant outside or inside count, this must be a flexible comparison. Therefore, each air sanitizing installation must be a comparison of three conditions; inside bacteria level before treatment and following treatment, both being controlled by outside counts.

The acceptance of such a procedure would demand the use of standard sampling devices. Such devices for air-borne bacteria are as confused as air sanitation itself[13]. In recent correspondence from the U.S. Public Health Service, the following comments were made:

> In very broad and general terms, I could only suggest that if you are sampling extremely large particles (20-200 microns) settling plates might be useful. For medium size particles (3-20 microns) a sieve sampler is probably more satisfactory, while for extremely small particles (0.3-3 microns) one of the liquid impingers would probably be best.

Because the proposed results will be comparative in nature the absolute efficiency of the measuring devices becomes relatively unimportant.

Simplicity and ease of operation prompted the use of a centrifugal impingement device[26] for this comparative investigation of bacteria levels though high efficiency has been demonstrated by some[27-29] and discredited by others[30,31]. Five samples taken over a period of one hour at a rate of 1 cfm for 10 min yield statistically valid average counts. Samples were collected on nutrient agar (5 percent blood) and incubated at 98.6 F for 48 hours in an effort to eliminate many of the saprophytes and to encourage the growth of those capable of inhabiting an animal host. Records were kept of number of total organisms per unit volume of air and also broken down into hemolytic organisms and molds to develop these types as a potential sanitary yardstick.

In the foregoing proposition there is one fallacy. In using simple reduction of inside air counts as an indicator of sanitary merit it is possible that the reduction of total counts is not reflected by a corresponding reduction in pathogenic counts. The vast majority of air bacteria are perfectly harmless. Therefore, over and above the reduction of room counts it must be demonstrated that a disinfectant mechanism has a specific effect against air-borne pathogens. Three pathogens which appear most frequently in the literature as common air infectors were chosen. These organisms secured from the American Type Culture Collection are *Corynebacterium diphtheriae 296 Staphylococcus aureus* 6538, and *Streptococcus pyogenes* 4543 (*Micrococcus pyogenes var. aureus*).

In a practical installation such as a washer, it was visualized that an organism could be picked up by the wash water, and, in one recirculation, be returned to the air stream quickly enough to be unaffected by a disinfectant. Therefore, a disinfectant must be of such strength as to destroy these pathogens within one recirculation time of the wash water. In most applications, this time was found to be 40 sec. Therefore, in comparing disinfectants, and in setting minimum concentrations of disinfectants, 95 percent kill of these three organisms is required before plant testing. If the proposed application is water, or another liquid, washed inocula are placed in tubes of these solutions under properly controlled temperature conditions for 40 sec. Percent kill is determined by standard dilution plate counts on the proper media, with proper control.

Experimental Results: Bacteria work has been directed toward the establishment of a consistent difference between inside and outside air. Over a 5-year period more than 5000 air samples have resulted in the average counts recorded in Table 2. This study has included counts primarily in buildings of the office and hotel types in and near business districts.

As indicated in Table 2, inside counts are 5 to 16 times higher than outside counts. Spaces which are not ventilated (*i.e.* no outside air) are 8 times greater than outside, while in those which are ventilated (dry coil systems) the outside air has diluted the inside bacterial loads to 4.6 times outside. Counts in spaces conditioned by washers freshly

Table 2—Micro-Organisms per 10 cu ft of Air at Different Locations and Conditions

Location	Total Organisms	Ratio to Outside Air	Mold	Hemolytes
Outside	12		1	1
Inside (Not Ventilated)	99	8.3	3	7
Inside (Ventilated)	55	4.6	3	4
Washer (Water — clean)	66	5.5	7	4
Washer (Water — dirty)	185	16.0	6.3	6.3
Washer (Chemically treated)	20	1.6	0.7	1.3

cleaned, approach the dry coil loads with a ratio of 5.5 while in dirty washers the ratio is 16, even with normal outside air.

The results of a chemically treated washer are also included. A disinfectant chemical under test was added to a dirty washer without outside air. The room air dropped to, and was maintained at, 1.6 times the outside level. Almost reaching the ideal outside count this chemical demonstrates its ability to substitute for outside air. Since it was first demonstrated that this chemical was disinfectant against the air-borne pathogens, it would be expected that this 90 percent reduction in total microflora would be reflected in similar reduction of pathogens. Similar extreme reduction of hemolytes and molds as shown, indicate a non-preferential reduction of air-borne bacteria.

Other Considerations

Many disinfectant and deodorant chemicals like those discussed have been investigated. Referring only to the disinfectant-deodorant techniques described, many have passed the requirements. However, there are other considerations which must be taken into account before a sanitizing mechanism can become a commercial product. The following are the requirements which have been found in an effort to further characterize air sanitizing agents:

1. It must be odorless and create no offensive odor.
2. It must be non-toxic.
3. It must be non-flammable and create no fire hazard.
4. It must be non-corrosive.
5. The mechanism must be understood as insurance against unknowing failure of the first four requirements.
6. The field control of this mechanism must be such as to be operated by non-technical personnel.
7. The mechanism must be such as to be free of undesirable end products.

Conclusions

It has been pointed out that air conditioning odor and bacteria control literature, though voluminous, has been of such individual and uncorrelatable nature, that at this time not only is there no program by which this subject can be pursued, but also there are no accepted basic methods by which the results of such a research program can be uniformly evaluated by this industry.

Basic techniques are described herein by which the air sanitation problem can be advanced more quickly by the securing of experimental results in fundamental terms. By the removal of the human descriptive element, the practical evaluation of progress and the comparison of results throughout the field are possible.

It has been shown that such studies must involve naturally occurring odor complexes, but that the control of such odors as burning tobacco, and cooking odors, is possible. Concentrations of tobacco odor are uniform and measurable, and, therefore, the deodorant effect of any chemical or mechanism can be quickly evaluated from the standpoint of efficiency, cost, and other limiting factors.

By the dilution-threshold method, odor results in a practical plant can be evaluated. By the establishment of odor loads, desirable odor levels, and odor removal efficiencies, the requirements of a deodorant are clarified and means for satisfying these requirements are given. It permits the solution of odor problems in an engineering manner and presents bases from which to specify for any installation.

Although there is no standard of bacterial air sanitation, it is demonstrated that there is a consistent difference between inside and outside air, and, by comparative measurement of inside and outside air counts, the degree of effectiveness of any mechanism for reducing bacteria levels can be determined. To be assured that a reduction in total room counts reflects a reduction of pathogen count, simplified disinfectant tests on certain air-borne infectors are recommended.

Satisfactory air sanitizing agents must not only be satisfactory from a disinfectant-deodorant viewpoint but must also be inoffensive, safe, noncorrosive and subject to control as already pointed out.

Acknowledgments

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Bibliography

1. Air Sanitation, by J. M. Dalla Valle (*Heating & Ventilating*, May 1949, pp. 57-71).
2. *Preventive Medicine and Hygiene*, by M. J. Rosenau (Sixth Edition, D. Appleton-Century, 1935).
3. Organic Matter in the Expired Breath, by M. J. Rosenau and H. L. Amoss (*Journal Medical Research*, 1911, p. 35).
4. Zehn Jahre Forshung Auf Dem Physikalisch-Medizinischen Grenzgebiet, by F. Dessauer (Leipzig, Georg Thieme, 1931).
5. Observations on Group of Subjects Before, During, and After Exposure to Ionized Air, by C. P. Yaglou, et al (*Journal Industrial Hygiene*, September 1933, pp. 341-53).
6. Environment and Health, U.S. Public Health Service, Federal Security Agency 1951.
7. Minimal Replenishment Air Required for Living Spaces, by W. V. Consolazio and L. J. Pecora (ASHVE TRANSACTIONS, 1947, p. 127).
8. Odors and the Sense of Smell (A Bibliography by Airkem, New York, 1952).
9. Aerobiology, by F. K. Moulton (*American Association for the Advancement of Science*, Washington, 1942).
10. *Odors, Physiology and Control*, by C. P. McCord (First Edition, McGraw-Hill Book Co., Inc., New York, 1949).
11. Studies in Air Hygiene (*Medical Research Council, Special Report, Series No. 262*, London, 1948).
12. *Experimental Air-Borne Infection*, by T. Rosebury (Williams & Wilkins Co., Baltimore, 1947).

13. *Flavor*, by E. C. Crocker (First Edition, McGraw-Hill Book Co., Inc., New York, 1945).

14. *The Chemical Senses*, by R. W. Moncrieff (Second Edition, Leonard Hill Ltd., London, 1951).

15. Henning's Olfactive Prism and the Preparation of Perfume Bases, by O. Gerhardt (*Parfumerie Moderne*, 1928, pp. 415-23).

16. Seeking a Working Language for Odors and Flavors, by E. C. Crocker (*Industrial and Engineering Chemistry*, 1935, pp. 1225-28).

17. The Effects of Moisture Content on the Diffusion of Odors in the Air, by R. L. Kuehner (ASHVE TRANSACTIONS, 1947, p. 77).

18. A Camera Inodorata, by H. Zwaardemaker (*Perfumery Essential Oil Record*, 1921, 12:243-44).

19. Determining Odors in Water, by G. M. Fair and W. F. Wells (*Water Works Engineering*, 1934, 87:1051-55).

20. Apparatus for Determining Odor in Water, by W. B. Hart (*Industrial and Engineering Chemistry*, May 1937, pp. 243-46).

21. ABC of Taste and Odor Control with Activated Carbon, by E. A. Sigworth (*Public Works*, September 1940, pp. 33-34, 37-40).

22. Studies on Accuracy of Threshold Odor Values, by R. Hulbert and D. Feben (*Journal American Water Works*, November 1941, pp. 1945-64).

23. Odor Identification of Chemical Warfare Agents, by E. M. Hoshall (*Chemical Warfare Bulletin*, July 1941, pp. 99-107).

24. Calculation of Threshold Odor, by H. A. Thomas (*Journal American Water Works Association*, June 1943, pp. 751-69).

25. *Rosenau Preventive Medicine and Hygiene*, by K. F. Maxcy (Seventh Edition, Appleton-Century-Crofts, New York, 1951).

26. Apparatus for the Study of the Bacterial Behavior of Air, by W. F. Wells (*American Journal Public Health*, 1933, pp. 58-59).

27. The Effectiveness of Certain Types of Commercial Air Filters Against Bacteria (B. Subtilis) by J. M. Dalla Valle and A. Hollaender (*U.S. Public Health Report*, 1939, pp. 695-99).

28. A Simple Device for Sampling Air-Borne Bacteria, by A. Hollaender and J. M. Dalla Valle (*U.S. Public Health Report*, 1939, pp. 574-77).

29. Electrostatic Method for Collecting Bacteria from Air, by C. M. Berry (*U.S. Public Health Report*, 1941, pp. 2044-51).

30. Hospital Masks: Their Bacterial Efficiency and Resistance to Air Flow — A Comparative Study, by R. Rooks, L. J. Cralley, and M. E. Barnes (*U.S. Public Health Report*, 1941, pp. 1411-19).

31. A Study of the Performance of the Wells Air Centrifuge, by E. B. Phelps and Leo Buchbinder (*Journal of Bacteriology*, 1941, pp. 321-44).

BATTELLE ESTABLISHES GERMAN INSTITUTE

The Battelle Memorial Institute for Germany is being established by *Battelle Memorial Institute*, an American research foundation of Columbus, Ohio. Battelle is also establishing a research center at Geneva, Switzerland, and has set up a program of fellowships for outstanding students in universities of both Switzerland and Germany.

The German center will be located in Frankfurt and will engage in chemical, metallurgical, and engineering research. The city of Frankfurt has donated the land for the center. The Frankfurt laboratory will consist of two major buildings costing approximately $1,000,000. It is expected that the buildings will be ready by June of 1953.

Battelle's staff in Europe now numbers 35, made up primarily of Europeans with a few American staff members on loan.

Battelle anticipates that the operation of this research center will assist European business and industry by providing new processes and ideas. Although Battelle is providing the initial capital for the establishment of this center, it is expected that European industries and governments and American industries in Europe will pay for the out-of-pocket costs for research plus overhead and depreciation, once the laboratories are operating.

Battelle believes that the development of a system of planning, organization and conducting of applied research will be helpful in strengthening the European economy.

WINSLOW RECEIVES PUBLIC HEALTH AWARD

Charles-Edward A. Winslow received a special ($2,500) award from the Albert & Mary Lasker Foundation for fathering modern public health practice, not only in the United States, but around the world.

Dr. C.-E. A. Winslow
New Haven, Conn.

During Dr. Winslow's youth public health was largely limited to water supply and sewage disposal, plus vaccinations against smallpox and faltering efforts to halt the spread of infectious diseases. Dr. Winslow worked in the state health departments of Massachusetts and New York, and in 1915 received a full professorship in public health at Yale University. For 30 years Dr. Winslow has given graduate courses to physicians, physiologists, bacteriologists, epidemiologists, nutritionists, mental hygienists and engineers working on water supply, sewerage and housing.

SCHECHTER ORGANIZES OWN FIRM

J. E. Schechter, Society member since 1950, has organized his own contracting engineering firm, the J. E. Schecter Corp. of New York City. Mr. Schechter, who will serve as chief engineer of the company, was formerly chief engineer with the James H. Martin Co., New York.

Graduating from the University of Southern California in 1935 with a B.S. in mechanical engineering, Mr. Schechter has been doing air conditioning engineering for approximately 22 years, particularly in industrial and large commercial type buildings.

Prior to joining the Martin firm, he was connected with the Frigidaire Division of General Motors Corp.

Mr. Schechter is also a member of the *American Society of Mechanical Engineers* and the *American Society of Refrigerating Engineers;* and he is a registered engineer in the state of New York.

Two Methods of Calculating the Friction in Pipe Lines

By F. E. Giesecke*, New Braunfels, Tex.

SUMMARY — The frequently used assumption that elbow friction loss in piping is equal to a length of pipe 25 diameters long, leads to considerable errors for pipes above 6 in. in diameter and also for pipes of all sizes when the velocities are above 1 fps. Correct friction loss should therefore be the sum of separate calculations of the friction loss in straight pipe and in the fittings. Friction heads for standard elbows from tests of Giesecke and Freeman are plotted for elbows up to 8 in. with water flowing at 1 fps.

A PIPE line consists of sections of straight pipe, elbows, and other single resistances; hence, to calculate the friction in a pipe line, it is necessary to know how to calculate the friction in a straight pipe and also how to calculate the friction in elbows and in other single resistances.

The friction in new and clean, black steel or wrought-iron, standard weight, pipe can be calculated accurately by means of the chart in THE GUIDE 1952 (p. 513) and also by means of similar charts and tables in other engineering books. Accurate charts and tables for use in calculating the friction heads in elbows and other single resistances are not now generally available.

In 1917 The University of Texas issued Bulletin No. 1759 — The Friction of Water in Pipes and Fittings. This bulletin describes a study conducted by the writer to determine the friction of water in pipes and fittings. The study of the friction in elbows led to the following general formula:

$$h = 0.0141\ d^{-0.26}\ v^{1.86} \quad \ldots\ldots\ldots (1)$$

where

h = friction head in one black iron, standard weight, 90 deg short radius, screwed elbow, feet of water.

d = internal diameter of the pipe, inches.

v = velocity of the water in the pipe, feet per second.

This study also led to the following statement:

> For the range of sizes (½ in. to 2½ in.) and velocities (0.56 fps to 2.66 fps) investigated, the friction of a standard 90-deg elbow is about the same as that of a pipe whose diameter is equal to that of the elbow and whose length is equal to 25 diameters.

This statement seems to be the origin of the belief now quite commonly held that the friction in one standard elbow is equal to the friction in a pipe whose nominal diameter is the same as that of the elbow, and whose length is 25 times its internal diameter.

Since the studies at The University of Texas were confined to standard elbows ranging in size from ½ in. to 2½ in. and to water velocities ranging from 0.56 fps to 2.66 fps, the suggestion that a pipe length of 25 diameters be considered equivalent to one elbow should be applied only within those limits. It seems, however, that the suggestion is frequently applied when the elbow is larger than 2½ in. and when the velocity is higher than 2.66 fps. For example, in THE GUIDE, 1952 (p. 485), it is stated that the friction in 17 ft of 8-in. pipe is equivalent to the friction in a standard 8-in. elbow, whereas, according to Table 1, the *equivalent length* of an 8-in. elbow ranges from 15.00 ft to 25.71 ft as the velocity ranges from 1 fps to 10 fps.

In 1892 J. R. Freeman, civil engineer, conducted a very extensive series of experiments in his New Hampshire laboratory to determine the friction of water flowing in pipes and fittings. The results of this classic study had been dormant for nearly 40 years when they were published by Mr. Freeman's son, Clarke, assisted by Dr. C. P. Kittredge and others.†

To determine the friction in standard elbows, Mr. Freeman performed 81 experiments. He experimented with elbows ranging in size from 2½ in. to 8 in. and with velocities ranging from 0.6 fps to 23.5 fps and found the following average friction heads per elbow:

2½-in. elbow, 12 experiments, $h = 0.772\ v^2/2g$ ft or $144\ v^2$ milinches
3-in. elbow, 12 experiments, $h = 0.742\ v^2/2g$ ft or $138\ v^2$ milinches
4-in. elbow, 28 experiments, $h = 0.631\ v^2/2g$ ft or $118\ v^2$ milinches
6-in. elbow, 22 experiments, $h = 0.574\ v^2/2g$ ft or $107\ v^2$ milinches
8-in. elbow, 7 experiments, $h = 0.457\ v^2/2g$ ft or $85\ v^2$ milinches

where

h = friction head of water per elbow, feet or milinches.

v = mean velocity of the water, in the pipe, feet per second.

Mr. Freeman's values of the friction heads in standard elbows, ranging in size from 2½ in. to 8 in., expressed in the form $h = Kv^2$ milinches and the writer's values of the friction heads in standard elbows, ranging in size from ½ in. to 2½ in., calculated by means of Equation 1, are shown in Fig. 1 for the velocity of 1 fps.

The curved line in Fig. 1 shows the average results of the two investigations; it was used to determine

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For presentation at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

†*Flow of Water in Pipe and Pipe Fittings*, by John Ripley Freeman, C.E. (published by *The American Society of Mechanical Engineers*, 1941, 350 pp.).

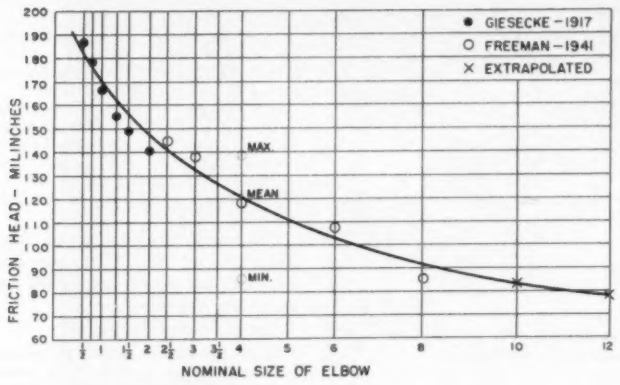


Fig. 1—Friction head in elbows from Giesecke and Freeman tests

For water flowing through a standard elbow with a velocity in the pipe of one foot per second.

the friction head coefficients for elbows of various sizes as shown in Table 2.

In considering the possible inaccuracy of this graphical method of finding the friction heads in standard elbows, it should be borne in mind that it is much more difficult to determine the friction heads in elbows than it is to determine the friction heads in 1 ft of straight pipe because the friction in an elbow is affected by the distance the pipe is screwed into the elbow, by the turbulence in the water when it enters the elbow, and by the roughness of the internal surface which may be different in elbows produced by different manufacturers. The difficulty of determining the friction head in an elbow is illustrated by Mr. Freeman's experimental study of the friction in a 4-in. elbow. His study included three sets of experiments: in the first set were 4 elbows, 20 ft apart, and 9 experiments; the average value of K (in $h = Kv^2/2g$) was 0.6251. In the second set were 4 elbows, 0.3 ft apart, and 12 experiments; the average value of K was 0.6981. In the third set were 4 elbows, 0.3 ft apart, and 7 experiments; the average value of K was 0.5348. The average value of K for the 28 experiments was $0.631v^2/2g$ ft or $118v^2$ milinches as shown in Fig. 1. The minimum of the 28 experimental values was 84 and the maximum value was 138 as shown by the two dotted circles in Fig. 1.

The corresponding friction heads, per foot of pipe, shown in Table 1, were taken from the chart on page 513 of THE GUIDE 1952. The friction heads shown in that chart were calculated by means of the equation

$$h = 31d^{-1.26}\ v^{1.84d^{-0.018}}\ \text{milinches}$$

Knowing the friction heads per elbow and per foot of pipe, the *equivalent lengths* of pipe per elbow were calculated and expressed in feet of pipe and in pipe diameters, as shown in Table 1.

It appears from Table 1 that, for a velocity of 1 fps, the *equivalent length* of pipe per elbow, ranging in size from ½ in. to 12 in., expressed in pipe diameters, ranges from 21 to 27 with the average of 24.2 and that, for the velocity of 10 fps, the range is from 32 to 42 with the average of 38.8.

Since velocities used in industry are generally higher than 1 fps, friction head calculations for pipe lines, based on the assumption that the *equivalent length* of the pipe is 25 times its internal diameter, are only approximately correct; hence this method of calculating friction heads may be called the *approximate method*. The name *correct method* may

Table 1—A Comparison of Friction Heads in Standard Elbows and Pipes
(For 1 and 10 fps Velocity)

Nominal Size	One foot per second velocity				Ten feet per second velocity			
	Friction Head (Milinches)		Equivalent of One Elbow		Friction Head (Milinches)		Equivalent of One Elbow	
	One Elbow	One foot of Pipe	Feet of Pipe	No. of Pipe Diameters	One Elbow	One foot of Pipe	Feet of Pipe	No. of Pipe Diameters
½	182	150	1.21	23	18,200	10,900	1.67	32
1	170	76	2.24	26	17,000	5,200	3.27	37
2	147	32	4.59	27	14,700	2,100	7.00	41
3	132	20	6.60	26	13,200	1,240	10.65	42
4	120	14	8.57	26	12,000	870	13.79	41
6	103	8.4	12.26	24	10,300	500	20.60	41
8	90	6.0	15.00	23	9,000	350	25.71	39
10	82	4.4	18.64	22	8,200	250	32.80	39
12	78	3.8	20.53	21	7,800	210	37.14	37
			Average	24.22			Average	38.77

Table 2—Friction Head Coefficients for Standard Elbows[a,b]

Nominal Size Inches	Value of K	Nominal Size Inches	Value of K	Nominal Size Inches	Value of K
½	182	2	147	5	111
¾	176	2½	140	6	105
1	170	3	132	8	90
1¼	162	3¼	127	10	82
1½	156	4	120	12	78

[a] A standard elbow is a black steel or wrought-iron, 90 deg, short radius, screwed elbow.
[b] For use in formula: $h = Kv^2$; h = milinches; v = feet per second.

be used when separate friction head calculations are made for the pipe and for the elbows and other single resistances, and the two calculated friction heads added to secure the final result.

Among the single resistances used in pipe lines, other than the standard elbow, are couplings, tees, valves, and radiators. The friction in these units is generally expressed in terms of the friction in a standard elbow, *i.e.*, in elbow equivalents. For example, the elbow equivalent of an open gate valve is considered to be 0.5; this value was determined for low velocities and small sizes. Since the friction in the single resistances varies practically as the square of the velocity, the elbow equivalent of a single resistance is the same for all velocities. This differs from the relation between the friction in a pipe and that in an elbow because the friction in a pipe varies practically as the 1.80 power of the velocity whereas the friction in an elbow varies practically as the square of the velocity; hence, if the *equivalent length* of an elbow is 25 pipe diameters for some one velocity it is more than 25 diameters for every higher velocity and less than 25 diameters for every lower velocity.

Whether the elbow equivalent of an open gate valve is 0.5 for all sizes of gate valves must be determined experimentally as was done for elbows by Mr. Freeman. Until this has been done it is necessary to assume that the number of elbow equivalents is not affected by the size of the fitting. In the case of gate valves it is safe to do so because there is generally not more than one gate valve in a pipe line.

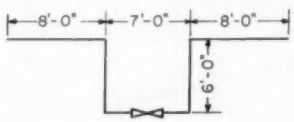


Fig. 2—Pipe line for illustration of friction loss calculations

The difference between the approximate method and the correct method of calculating friction can be found by calculating the friction heads in the pipe line shown in Fig. 2 for velocities of 1 fps and 10 fps. The pipe line consists of 35 ft of 4-in. pipe, 4 elbows, and one gate valve, or of 35 ft of pipe and 4.5 elbow equivalents.

For a velocity of 1 fps:

By the approximate method the equivalent length of the pipe line is $35 + 4.5 \times 25 \times 4.026/12$ or 72.7 ft and the friction head is $72.7 \times 14 = 1018$ milinches.

By the correct method the friction head in the pipe is 35×14 or 490 milinches and in the five single resistances (4.5 elbow equivalents) it is 4.5×120 or 540 milinches, and, together, $490 + 540 = 1030$ milinches, a difference of only one percent.

This shows that, for a 4-in. pipe and a velocity of 1 fps, the approximate method gives results which are practically correct.

For a velocity of 10 fps:

By the approximate method, the equivalent length of the pipe line is as before 72.7 ft; the friction head is $72.7 \times 870 = 63{,}249$ milinches or 5.27 ft.

By the correct method, the friction head in the pipe is $35 \times 870 = 30{,}450$ milinches and in the five single resistances it is $4.5 \times 120 \times 100 = 54{,}000$ milinches and the total is $30{,}450 + 54{,}000 = 84{,}450$ milinches or 7.04 ft.

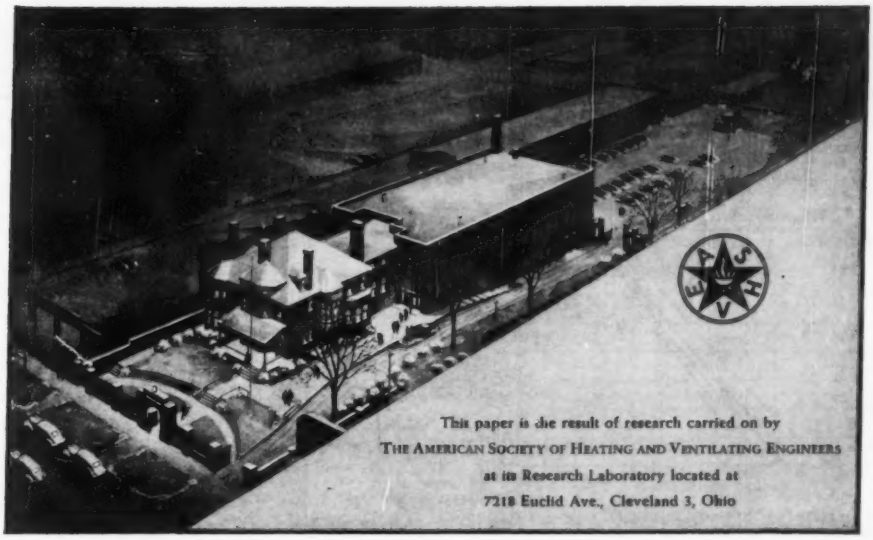
According to these calculations the friction head calculated by the approximate method is 25 percent lower than that calculated by the correct method. So great an inaccuracy is not permissible in good engineering design and, since the correct method is practically as simple as the approximate method, it is best to abandon the use of the approximate method entirely.

ASHVE BUDGET ADOPTED

For the fiscal year November 1, 1952 to October 31, 1953 the Council at its Fall meeting approved the following budget of estimated income and expenses:

	1952-1953 Budget (12 months)
INCOME	
Headquarters	
Schedule A—Dues (60 percent)	$122.670.00
Schedule B—Publications	159,500.00
Schedule C—Investments	1,000.00
Schedule D—Other Income	2,400.00
Total Headquarters	$285,570.00
Research	
Schedule E—Research	$178,390.00
Total Income	$463,960.00
EXPENSES	
Headquarters	
Schedule F—Committees and Chapters	$21,550.00
Schedule G—Meetings	8,500.00
Schedule H—Publications	112,300.00
Schedule I—Headquarters	128,650.00
Schedule K—Fund Raising	15,500.00
Total Headquarters	$286,500.00
Research	
Schedule J—Research	177,450.00
TOTAL EXPENSES	$463,950.00
Excess of Income over Expenses	$10.00

ASHVE
Future Meetings
Denver
June 22-24, 1953
•
Houston
January 25-29, 1954
•
Don't Miss CHICAGO, in January '53


This paper is the result of research carried on by
THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS
at its Research Laboratory located at
7218 Euclid Ave., Cleveland 3, Ohio

Heat Exchanges in a Ceiling Panel Heated Room

By L. F. Schutrum*, G. V. Parmelee**, and C. M. Humphreys†,
Cleveland, Ohio

SUMMARY — **An experimental study has been made of heat exchanges within a ceiling panel heated room in which all surface temperatures were controlled.**

Most tests were made with the floor and walls at a uniform surface temperature, and heat exchange rates between the heated ceiling and the colder surfaces are given. Results are also included for a few exploratory tests in which the unheated surfaces were at non-uniform temperatures.

The effects of infiltration on room air temperature and ceiling panel heat flow rates are given.

THIS PAPER is the first of a series which will deal with the problem of heat exchanges within panel heated and cooled spaces. The results in this paper are restricted to ceiling panel heated spaces in which the entire ceiling area is heated. Most of the tests were made with a simple room arrangement in which all parts of the floor and walls had the same surface temperature. However, since some tests were made to explore the effects of a departure from this condition of uniform environment, the results from these are included.

Research on the subject of heat exchanges within panel heated spaces is part of the long-range program of the ASHVE Technical Advisory Committee on Panel Heating and Cooling which has for its ultimate aim the development of reliable design data. Previous papers describing the results of research on other phases of the program have dealt primarily with studies of heat flow within concrete and plaster panels. The work described in this paper has had the advisory guidance of Group B‡ of the Technical Advisory Committee on Panel Heating and Cooling and was carried on in the newly completed Environment Laboratory of the ASHVE Research Laboratory in Cleveland.

Test Apparatus

The new ASHVE Environment Laboratory, equipped and instrumented for direct measurement of heat flow rates through all six surfaces of the room, has been described in a previous paper[1]. The interior surfaces of the room are made up of 75 aluminum panels of various sizes arranged to provide maximum flexibility in surface temperature control. All room side surfaces were painted with a semi-gloss gray paint.

Low-inertia, low-resistance heat flow meters which also have been described previously[2], cover approximately ten percent of the inside surface area of the room, the dimensions of which are 24 ft 6 in. by 12 ft with an 8-ft ceiling height.

Surface temperatures were measured by thermocouples cemented in

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For presentation at the 59th Annual Meeting of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Chicago, January 1953.

‡Personnel: J. M. van Nieukerken, *chairman;* C. O. Mackey, *vice chairman*: C. M. Ashley, C. F. Boester, W. P. Chapman, W. S. Harris, Linn Helander, J. W. James, A. T. Jorn, C. F. Kayan, H. A. Lockhart, W. E. Long, R. L. Maher, R. A. Miller, D. L. Mills, G. L. Wiggs.

[1]Exponent numerals refer to References.

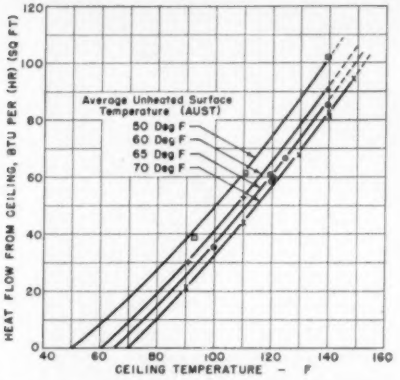
HEAT FLOW FROM CEILING, BTU PER (HR) (SQ FT)
CEILING TEMPERATURE – F
Average Unheated Surface Temperature (AUST)
50 Deg F
60 Deg F
65 Deg F
70 Deg F

Fig. 1—Heat flow from the ceiling *vs.* ceiling temperature and AUST

No infiltration — uniform environment (24½ x 12 x 8 ft high room)

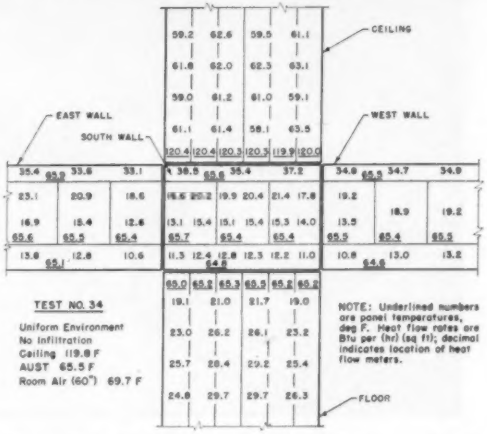
CEILING
EAST WALL
SOUTH WALL
WEST WALL
FLOOR
TEST NO. 34
Uniform Environment
No Infiltration
Ceiling 119.8 F
AUST 65.5 F
Room Air (60") 69.7 F
NOTE: Underlined numbers are panel temperatures, deg F. Heat flow rates are Btu per (hr) (sq ft); decimal indicates location of heat flow meters.

Fig. 2—Heat flow and temperature distribution for south half of Environment Laboratory

Uniform environment, no infiltration (24½ x 12 x 8 ft high room)

grooves cut into the backs of the aluminum panels.

Air temperatures, measured by butt soldered 36 gage copper-constantan thermocouples, were taken at six locations along two walls and at various levels in the center and near one end of the room.

Infiltration was recognized as an important factor affecting both room air temperatures and panel outputs. The infiltration air, introduced into the room by way of 6 vertical 2 in. diameter perforated pipes closed at the top, was metered by means of an orifice. Four of the 6 pipes were located along one long wall (east) and 2 along one short wall (south). Since it was felt desirable to define the manner of exit of this air as completely as possible, the room was fairly tightly sealed and the door cracks were taped. Under such conditions about 50 percent of the infiltration air left the room at the floor level through a 6-ft long slot, about 0.4 sq ft in area, in the center of the north half of the west wall, and its temperature was taken at this point. The remaining 50 percent of the infiltration air undoubtedly left the room through small cracks between panels on the various room surfaces.

In a normal house or building there is, of course, considerable uncertainty as to the actual entrance and exit temperatures of infiltrating air.

Test Procedure

All data covered by this report were taken under steady state conditions and mainly with a uniform environment. Panel temperatures and infiltration rates and temperatures were controlled; room air temperatures and heat flow rates were the dependent variables.

In this report the term *uniform environment* describes a condition wherein all panels of the four walls and the floor were maintained at the same surface temperature. The term *non-uniform environment* indicates a condition wherein floor and wall surfaces were not at the same temperature. The term *neutral surface* describes a room surface which was neither heated nor cooled by liquid circulation, but was allowed to seek its own temperature level. As the back of each panel was insulated, and the temperature of the air behind the insulated panel was controlled, the heat flow under these conditions was very small.

Most of the tests described herein were made with the test room unoccupied, unlighted, and containing only the necessary instrumentation. A few tests were made with the room lighted and furnished to simulate a normal living room.

Calibration

The heat flow meters were individually calibrated in place by means of a portable calibrator[2].

Although this individual calibration assured precise heat flow meter measurements at each heat flow meter location, it was also necessary to investigate the integrating and averaging ability of the meter for the panel area surrounding it. This was done by installing 24 500-watt incandescent lamps in the room, measuring the electrical energy input, and measuring the heat outflow from the room with the heat flow meters. In most of the tests the lamps were distributed uniformly over the room, but in one test all of the heat was supplied to one half of the room. The average difference between the metered heat input and output rates in these tests was approximately 5 percent with the heat flow meters showing the higher value.

The reliability of heat flow measurements in the Environment Laboratory was also proved by the heat balance obtained in each test. The heat flowing into the laboratory from the heated ceiling panel must equal the heat flow out through cooled or

neutral panels for conditions of no infiltration and no other internal heat sources. In 26 tests with uniform environment the average difference between the metered heat input and heat output was less than one percent of the total heat flow. The maximum difference was within ± 5 percent; the difference in 10 of the 26 tests was less than one percent. In general, the measured heat flow from the ceiling panels was slightly lower than the total heat flow outward through the other surfaces.

Test Results — Uniform Environment

Heat Flow: No Infiltration

The first series of tests in the Environment Laboratory was made with uniform environment, no infiltration air, the entire ceiling heated, and the room dark and unoccupied. The heat flow rates are shown in Fig. 1 as a function of the ceiling temperature and the area weighted average temperature of the unheated surfaces of the room. This *average unheated surface temperature* will be referred to hereafter as the AUST. The experimental temperatures were not always at the nominal curve temperatures and thus the curves do not pass through all the points. Except for the door temperature, which was not controlled, the individual panel temperatures were within ± one deg of the AUST.

Table 1 shows temperature and heat flow data for Test No. 34. The distribution of heat leaving the room through the cooled surfaces is typical of the tests with a uniform environment and no infiltration. The distribution is given for each surface as total heat flow, percent of ceiling input, and heat flow per square foot of surface. Also given is the calculated net radiant energy exchange between each surface and the remaining room surfaces expressed as a percentage of the net exchange between the ceiling and the entire room. The calculations are based upon the observed surface temperatures and black body radiation. Since the exact emissivity of the room surfaces is not yet known and since the results of the calculations are expressed as percentages, no further refinement in calculation seemed justified. The angle factors for the surfaces with respect to the ceiling are also included. The percent black body radiation exchange, given in the last column, compares favorably with the percent of ceiling heat flow. This indicates that the heat transfer occurs largely by radiation.

Table 1—Heat Flow Distribution for Uniform Environment with No Infiltration
Test No. 34 (AUST: 65.5 F)
Air Temperatures at Center of Room: 67.3 F at 30-inch level; 69.7 F at 60-inch level

Surface	Surface Temp. F	Total Heat Flow Btu/hr	Percentage of Ceiling Heat Flow	Heat Flow Btu/hr (sq ft)	Angle[a] Factor	Percentage[b] Radiant Energy Exchange
Ceiling	119.8	17,995	100.0	59.8		100.0
Floor	65.3	7,585	42.1	25.2	0.425	42.8
North (incl. door)	67.3	1,210	6.7	12.7	0.090	8.8
South	65.3	1,755	9.8	18.3	0.090	9.2
West	65.3	3,765	20.9	19.2	0.197	19.3
East	65.2	3,665	20.4	18.7	0.197	19.9
Total:						
Walls and Floor		17,980	99.9			
Unaccounted for		−15	+0.1			

[a]A geometrical factor which takes into account both the shape and the relative position of the surfaces. It represents, as a fraction, the radiant energy emitted from the ceiling which is intercepted by each surface, with no allowance made for reflections. See Reference 4.
[b]This is the calculated net radiant energy exchange between each surface and the rest of the room. Calculation based on emissivity = 1.0.

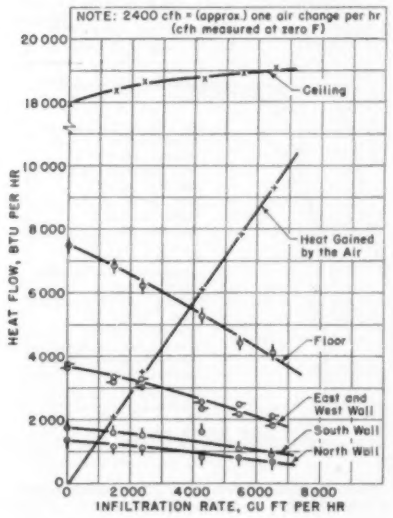
NOTE: 2400 cfh = (approx.) one air change per hr (cfh measured at zero F)
HEAT FLOW, BTU PER HR
INFILTRATION RATE, CU FT PER HR
Ceiling
Heat Gained by the Air
Floor
East and West Wall
South Wall
North Wall

Fig. 3—*(Left)* Effect of infiltration rate on heat flow
Ceiling at 120 F, all other surfaces at 65 F; 0 F infiltration air temperature (24½ x 12 x 8 ft high room)

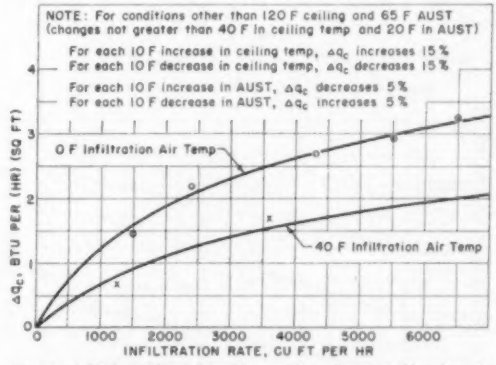
NOTE: For conditions other than 120 F ceiling and 65 F AUST (changes not greater than 40 F in ceiling temp and 20 F in AUST)
For each 10 F increase in ceiling temp, ΔQc increases 15%
For each 10 F decrease in ceiling temp, ΔQc decreases 15%
For each 10 F increase in AUST, ΔQc decreases 5%
For each 10 F decrease in AUST, ΔQc increases 5%
0 F Infiltration Air Temp
40 F Infiltration Air Temp
ΔQc, BTU PER (HR) (SQ FT)
INFILTRATION RATE, CU FT PER HR

Fig. 4—Additional heat flow from ceiling due to infiltration air
Ceiling at 120 F, all other surfaces at 65 F (24½ x 12 x 8 ft high room)

Table 2—Heat Flow Distribution for Uniform Environment with Infiltration
Test No. 61 — 2-1/3 Air Changes at Zero F (AUST: 65.5 F)
Air Temperature at Center of Room: 56.0 F at 30-inch level; 61.0 F at 60-inch level. Air Temperature at Exit Slot: 56.2 F

Surface	Surface Temp. F	Total Heat Flow Btu/hr	Percentage of Ceiling Heat Flow	Heat Flow Btu/(hr) (sq ft	Angle[a] Factor	Percentage[b] Radiant Energy Exchange
Ceiling	119.5	18,555	100.0	63.0		100.0
Floor	65.4	4,450	23.5	14.8	0.425	42.6
North (incl. door)	66.4	865	4.5	9.1	0.090	8.9
South	65.3	1,115	5.9	11.6	0.090	9.0
West	65.3	2,490	13.1	12.7	0.197	19.8
East	65.4	2,195	11.6	11.2	0.197	19.7
Heat Gain by Air		7,840[c]	41.4			

[a]A geometrical factor which takes into account both the shape and the relative position of the surfaces. It represents, as a fraction, the radiant energy emitted from the ceiling which is intercepted by each surface, with no allowance made for reflections. See Reference 4.
[b]This is the calculated net radiant energy exchange between each surface and the rest of the room. Calculation based on emissivity = 1.0.
[c]Heat gain by air by difference.

Since there was no infiltration air supplied in this test, the heat input to the room from the ceiling should equal the heat flowing from the room through the other five surfaces. The total at the bottom of the table indicates a difference of only 15 Btu per hr in these two values.

Fig. 2 shows surface temperature and heat flow distribution in the south half of the test room, also for Test No. 34. The average surface temperature of each panel and the heat flow rate in Btu per (hr) (sq ft) at each heat flow meter location are noted. This shows that although the average temperatures of the individual panels of the walls and floor are very nearly the same, the heat flow rates are much higher at the top of the walls near the heated ceiling than near the floor. In practice this would probably be somewhat different because the wall surface temperature would not be the same at all points.

Heat Flow: With Infiltration

The effect of infiltration on heat flow rates is illustrated by Fig. 3. This shows the results of tests in which the rate of infiltration was varied while the ceiling temperature was held at 120 F and the other surfaces at 65 F. The temperature of the infiltration air was held at zero F. It will be seen that the ceiling heat flow increases slightly with an increase in infiltration rate; conversely, the other five surfaces show a decrease in heat flow. These heat flows are influenced both by increased air movement and decreased room air temperature. The number of air changes is based upon the density at the temperature of the infiltration air. Table 2 shows the heat flow distribution for Test No. 61, one of the series shown in Fig. 3. Note that although surface temperatures are nominally the same as in Test No. 34, Table 1, the heat flow distribution is considerably altered.

The additional heat flow, *Qc*, from the ceiling due to infiltration air is shown by the curves of Fig. 4. For

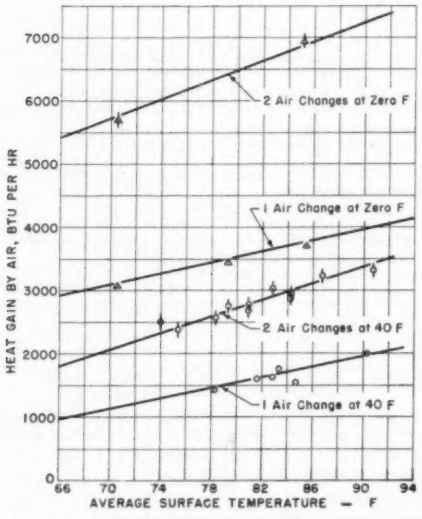

Fig. 5—Heat gain by infiltration air *(24½ x 12 x 8 ft high room)*

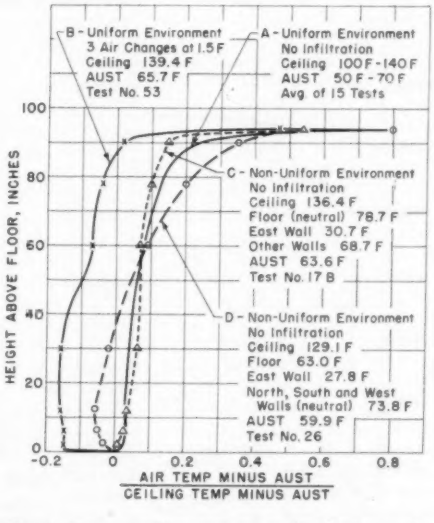

Fig. 6—Floor to ceiling temperature distribution at the center of room *(24½ x 12 x 8 ft high room)*

ceiling temperatures and AUST other than 120 F and 65 F respectively, approximate corrections can be made as noted in the figure.

Heat Transfer to the Air

Under conditions of no infiltration the net heat transfer to the air is zero, that is, the heat transferred from the warm surfaces to the air equals the heat transferred from the air to the cold surfaces. With infiltration there is a steady flow of air through the heated space which produces a heating load equal to:

1. The difference between the total heat inflow from the ceiling and the heat flow out through the walls and floor, or
2. The sum of differences in heat flow for each surface with and without infiltration, if the surface temperatures are identical in each case, or
3. The weight rate of flow times the specific heat at constant pressure times the difference between the temperatures of the exit and the entering air.

Each method should yield identical results. The heat transferred to the air shown in Fig. 3 was substantially the same whether Method 1 or Method 2 was used. Had all the infiltration air left the room in such a way that its temperature could have been determined, the heat transferred to the air could have been determined by Method 3. Since the exit air temperature was known for only the 50 percent of the air which left the room by way of the slot previously described, Method 3 could not be used without some approximation. However, it was found that if the temperature of the air leaving through the cracks between the panels was assumed to be equal to the area-weighted average temperature of all room surfaces, and this was averaged with the measured exit temperature, Method 3 gave good correlation with the other two methods, and with considerably less experimental scatter. This calculated average exit air temperature was in all cases higher than the air temperature at the 60-in. level at the center of the room. The curves of Fig. 5 were determined by Method 3 and show that heat gain by the infiltration air is dependent upon the rate of change and the temperature of the infiltration air and the *area-weighted average temperature* of all the room surfaces. This temperature will hereafter be referred to as the AST.

It should be understood that the values of Fig. 5 apply only to the test room and the manner in which the infiltration air entered and left the room. There is some experimental evidence to show that the latter has a significant effect on heat transfer to the air.

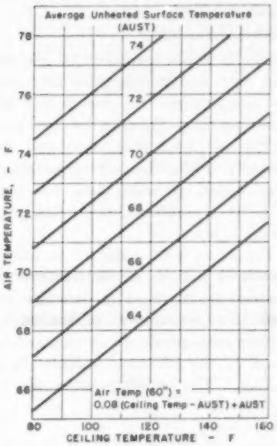

Fig. 7—Air temperature at 60-in. level, center of room, *vs.* ceiling temperature and AUST

No infiltration — uniform environment (24½ x 12 x 8 ft high room)

Room Air Temperature: No Infiltration

Fig. 6 shows the air temperature gradients from floor to ceiling for various test conditions. The ordinate is the height above the floor and the abscissa is a dimensionless ratio of temperature differences. For all tests with a uniform environment and no infiltration it was found that the gradient could be represented by Curve A regardless of ceiling temperature and AUST. On the basis of Curve A, Fig. 7 was constructed

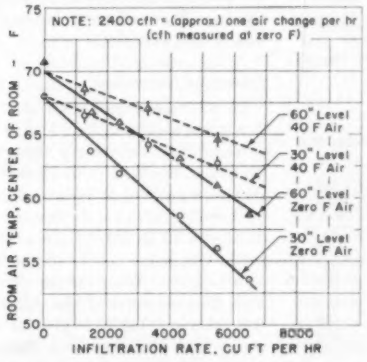
NOTE: 2400 cfh = (approx.) one air change per hr (cfh measured at zero F)
ROOM AIR TEMP, CENTER OF ROOM - F
INFILTRATION RATE, CU FT PER HR
60" Level 40 F Air
30" Level 40 F Air
60" Level Zero F Air
30" Level Zero F Air

Fig. 8—The effect of infiltration air rate and temperature on room air temperature

Ceiling 120 F, all other surfaces 65 F (24½ x 12 x 8 ft high room)

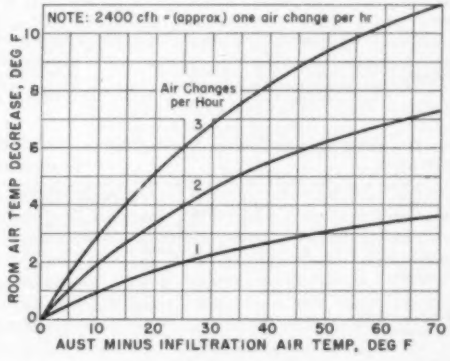
NOTE: 2400 cfh = (approx.) one air change per hr
ROOM AIR TEMP DECREASE, DEG F
AUST MINUS INFILTRATION AIR TEMP, DEG F
Air Changes per Hour
3
2
1

Fig. 9—Decrease in room air temperature at the 60-in. level *vs.* infiltration air temperature and rate

Uniform environment (24½ x 12 x 8 ft high room)

to give the relationship between air temperature at the 60-in. level and AUST and ceiling temperature. It was found that dewpoint temperature had a measurable effect on room air temperature because of absorption of radiation. Air temperatures were therefore corrected empirically to a 30 F dew-point basis. It should be noted that there can be only one air temperature for a given ceiling temperature and AUST. Fig. 7 shows that to change the air temperature one degree requires a change of 12 deg in ceiling temperature or 1.1 deg change in AUST. The following relationship between AST and Room Air Temperature can be developed from Fig. 6:

$$\text{AST} - \text{Air Temperature} = \left\{ \frac{\text{Ceiling Area}}{\text{Total Surface Area}} - C \right\} (\text{Ceiling Temp.} - \text{AUST})$$

C is a constant obtained from Curve A of Fig. 6. For the 60-in. level $C = 0.08$.

It was found that the air temperature at the 60-in. level was substantially constant throughout the room. The uniformity of air temperatures at the other levels was not investigated.

Room Air Temperature: With Infiltration

Fig. 8 shows the effect of infiltration rate and temperature on room air temperature. It shows that the room air temperature is lowered with increasing infiltration rate and decreasing infiltration air temperature. This figure presents data for zero and 40 F infiltration air temperatures.

From curves similar to those shown in Fig. 8, an air temperature correction curve, Fig. 9, was obtained. For simplicity, infiltration is given in terms of air changes instead of the previous volume designation. The ordinate gives the reduction in air temperature which would result from any combination of infiltration rate and temperature. For example, consider a ceiling panel of 118 F and AUST of 67 F. With no infiltration the room air temperature at the 60-in. level would be 71 F (See Fig. 7). If there were one air change per hour at 20 F entering air temperature, the room air temperature would be depressed 3 deg. This would give a room air temperature of 68 F. This correction is found from Fig. 9 and corresponds to a difference of 47 deg between the AUST of 67 F and the infiltration air temperature of 20 F.

No single curve was found which would give the temperature gradient for tests with infiltration. Curve B of Fig. 6 shows the temperature gradient for Test No. 53 with infiltration and uniform environment.

Air Motion

Air velocities were measured by a hot wire anemometer which was developed[3] at the ASHVE Research Laboratory for the investigation of room air distribution. The air velocities in the center of the room at the 3½-in., 30-in., and 60-in. levels were about 10 fpm for the tests without infiltration but increased to about 30 fpm with the higher infiltration rates. The direction of air movement was not determined and since at velocities of the order of 10 fpm, the yaw correction to the instrument readings may be as much as 25 percent, the values cited are approximate.

No definite air motion existed for the uniform environment without infiltration except for a downward movement within a fraction of an inch of the walls. With infiltration, the entering air tended to drop toward the floor and move in the direction of the exit slot.

Effects of Convection

It was recognized that the heat flow rates shown in Fig. 1 were lower than those commonly thought to prevail in the field. An attempt was therefore made to increase these rates by creating greater air motion. To do this, a 15 in. floor fan was placed in the northeast corner of the room at a height of 60 in. above the floor and directed toward the center of the ceiling. Table 3 gives a comparison of the heat flow rates obtained with and without the fan in operation. Since the surface temperatures for the two tests differed by less than 1 deg, the radiation ex-

Table 3—Effect of Air Motion on Heat Flow Rates for Uniform Environment

Surface	Average heat flow rate Btu/(hr) (sq ft)		Percentage Increase
	Fan not operating	Fan operating	
Ceiling	58.9	86.9	47.5
Floor	24.2	32.3	33.5
North Wall	14.0	20.2	44.3
South Wall	19.1	32.3	69.1
East Wall	20.1	29.9	48.8
West Wall	19.5	29.3	50.3
Air Temperature, Fahrenheit, at 60-in. level, center of room	71.6	80.7	

Test Conditions — Ceiling temp.: 120 F (nominal)
All other surfaces: 65 F (nominal)
No infiltration
Air velocity at fan:
750 fpm heat input
to fan: 208 Btu/hr

Table 4—The Effect of Non-Uniform Environment on Ceiling Heat Flow with No Infiltration

Test Series No.	Controlled Variable	Test No.	Ceiling	Surface Temperatures, F				Ceiling Heat Flow Btu/(hr) (sq ft)	
				Floor	Glass (East) (Wall)	Other Walls	AUST	Non-Uniform	Uniform (Fig. 1)
I	Ceiling Temperature	18	105.9	N*65.9	29.4	66.8	58.3	51.5	49.5
		19	119.7	N 70.5	29.1	66.3	59.5	66.9	66.0
		16	135.7	N 76.1	28.9	67.2	61.8	86.4	84.0
II	Simulated Glass Temperature	19	119.7	N*70.5	29.1	66.3	59.5	66.9	66.0
		20	119.8	N 75.2	38.4	66.0	63.0	63.9	62.0
		21	120.2	N 76.1	46.5	65.7	65.0	61.9	61.0
III	Simulated Glass and Ceiling Temperatures	26	129.1	63.0	27.8	N*73.8	59.9	76.7	77.5
		27	110.9	63.3	27.2	N 68.3	57.5	56.7	56.0
		28	142.1	65.1	33.0	N 78.6	63.9	91.4	91.0

*Neutral surface (neither heated nor cooled).

change was essentially the same. The marked increase in total heat flow must, therefore, have resulted from an increase in convection. The particularly large increase of the south wall heat flow was due to the direct impingement of the air stream on this surface.

Another interesting comparison may be made from the data obtained in these tests. It is reasonable to believe that the emissivity of the room surfaces is about 0.9, although no direct measurements have as yet been made. The radiation exchange between the ceiling and the rest of the room was calculated with this emissivity. Some allowance was made for reflections. The convective heat transfer was then determined as the difference between the total and radiant heat flow. The convection coefficient for the ceiling for these two conditions, based on the temperature difference between the air at the 60-in. level in the room center and the ceiling, are as follows:

with fan h_i = 0.80 Btu per (hr) (sq ft) (F deg)
without fan h_i = 0.04 Btu per (hr) (sq ft) (F deg)

Surface Temperature and Wall Conductance

For a uniform environment let a wall conductance, C', be defined as the quotient of the total heat flow through all the unheated surfaces divided by the product of the area of these surfaces times a uniform temperature difference between the inside surface and the outdoor air. Then the room surfaces, exclusive of the heating surface, can represent an outside wall the conductance of which, for a given inside surface temperature and heat flow rate, varies with the temperature which is assigned to the outside air. For example, a heat flow rate of 10 Btu per (hr) (sq ft) and a surface temperature of 65 F could represent combinations of wall conductance and outdoor air temperature respectively of 0.5 Btu per (hr) (sq ft) (F deg) and 45 F, 0.20 and 15 F, or any combination in which the product of conductance and temperature difference equaled 10 Btu per (hr) (sq ft).

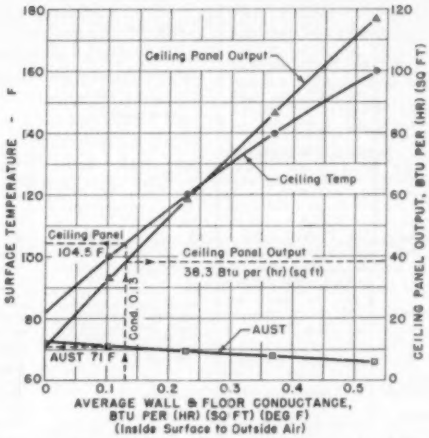
Ceiling Panel Output
Ceiling Temp
Ceiling Panel
104.5 F
Ceiling Panel Output
38.3 Btu per (hr) (sq ft)
Cond. 0.15
AUST
AUST 71 F
SURFACE TEMPERATURE - F
CEILING PANEL OUTPUT, BTU PER (HR) (SQ FT)
AVERAGE WALL & FLOOR CONDUCTANCE, BTU PER (HR) (SQ FT) (DEG F) (Inside Surface to Outside Air)

Fig. 10—The effect of wall conductance on the AUST and on the ceiling temperature and output required to maintain 70 F room air temperature at the 60-in. level

0 outside, one air change at 0 F (24½ x 12 x 8 ft high room)

The effect of the wall conductance on the AUST and on the ceiling temperature and heat flow required to maintain an air temperature of 70 F at the 60-in. level is shown in Fig. 10 for conditions of zero F outside air and one air change based upon air density at zero F. The figure illustrates one combination of values. Note that for values of C' greater than about 0.20 the AUST is below 70 F and heat flow is from the air to the walls. For values of C' less than 0.20 the opposite is true. It is important to realize that Fig. 10 applies only to the room and the conditions noted.

Test Results — Non-Uniform Environment

Tests were made with various combinations of floor and wall temperatures to explore the performance of a ceiling panel with a non-uniform environment. The results of these tests are shown in Table 4. In Series I the ceiling temperature was the variable while the temperatures of the east wall (simulating glass area) and the other walls were held constant. The floor was a neutral surface, that is, was allowed to seek its own temperature level. In Series II the glass temperature was the controlled variable. The floor again was a neutral surface. In Series III both ceiling and glass temperatures were the variables. The floor was held at a fixed temperature while three walls were neutral surfaces.

The next to the last column of the table gives the ceiling heat flow rates obtained under the various non-uniform test conditions. The last column gives the heat flow rates for the same AUST but for uniform surroundings. These values were obtained from Fig. 1. For these particular tests the agreement is very good and suggests that AUST may be a satisfactory term to describe a non-uniform surrounding. This needs further investigation.

The results of Test No. 26 are given in more detail in Table 5 and Fig. 11. These bring out several important points that sometimes are overlooked. First, it should be noted that the temperatures of the neutral surfaces are well above the temperature of the ambient room air. These temperatures result from an equilibrium condition such that the heat gain by radiation exchange with the ceiling equals the heat lost in the radiation exchanges with the colder

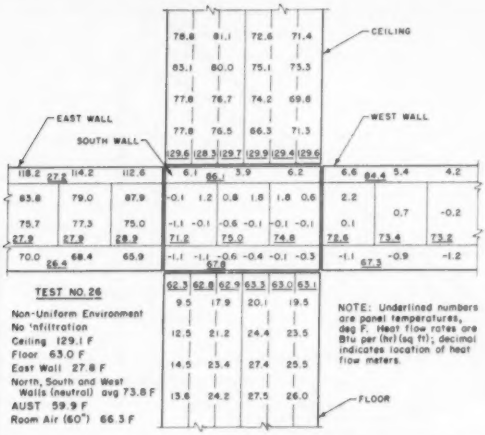
CEILING
EAST WALL
SOUTH WALL
WEST WALL
FLOOR
78.8 81.1 72.6 71.4
83.1 80.0 75.1 75.3
77.8 76.7 74.2 69.8
77.8 76.5 66.3 71.3
129.6 128.3 129.7 129.9 129.4 129.6
118.2 27.8 114.2 112.6
6.1 66.1 3.9 6.2
6.6 84.4 5.4 4.2
83.8 79.0 87.9
75.7 77.3 75.0
27.9 27.9 28.9
70.0 26.4 68.4 65.9
2.2 0.7 -0.2
72.6 73.4 73.2
67.8
67.3
62.3 62.8 62.9 63.3 63.0 63.1
9.5 17.9 20.1 19.5
12.5 21.2 24.4 23.5
14.5 23.4 27.4 25.5
13.6 24.2 27.5 26.0
TEST NO. 26
Non-Uniform Environment
No Infiltration
Ceiling 129.1 F
Floor 63.0 F
East Wall 27.8 F
North, South and West Walls (neutral) avg 73.8 F
AUST 59.9 F
Room Air (60") 66.3 F
NOTE: Underlined numbers are panel temperatures, deg F. Heat flow rates are Btu per (hr) (sq ft); decimal indicates location of heat flow meters.

Fig. 11—Heat flow and temperature distribution for south half of Environment Laboratory

Non-uniform environment, no infiltration

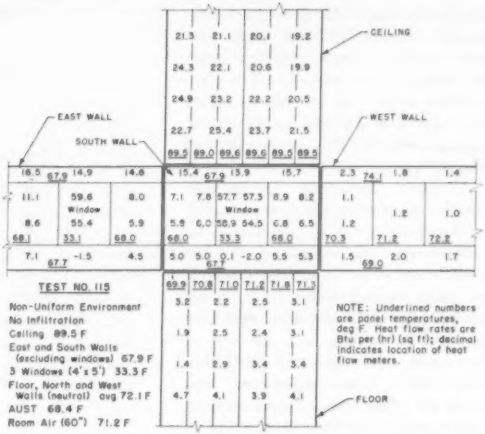
CEILING
EAST WALL
SOUTH WALL
WEST WALL
FLOOR
21.3 21.1 20.1 19.2
24.3 22.1 20.6 19.9
24.9 23.2 22.2 20.5
22.7 25.4 23.7 21.5
89.5 89.0 89.6 89.6 89.5 89.5
18.5 67.9 14.9 14.6
15.4 67.9 13.9 15.7
2.3 74.1 1.8 1.4
11.1 59.6 8.0
Window
8.6 55.4 5.9
68.1 33.1 68.0
7.1 67.7 -1.5 4.5
7.1 7.8 57.7 57.5 8.9 8.2
Window
5.9 6.0 58.9 54.5 6.8 6.5
68.0 33.3 68.0
5.0 5.0 0.1 -2.0 5.5 5.3
67.7
1.1
1.2 1.2 1.0
70.3 71.2 72.2
1.5 69.0 2.0 1.7
69.9 70.8 71.0 71.2 71.8 71.3
3.2 2.2 2.5 3.1
1.9 2.5 2.4 3.1
1.4 2.9 3.4 3.4
4.7 4.1 3.9 4.1
TEST NO. 115
Non-Uniform Environment
No Infiltration
Ceiling 89.5 F
East and South Walls (excluding windows) 67.9 F
3 Windows (4'x 5') 33.3 F
Floor, North and West Walls (neutral) avg 72.1 F
AUST 68.4 F
Room Air (60") 71.2 F
NOTE: Underlined numbers are panel temperatures, deg F. Heat flow rates are Btu per (hr) (sq ft); decimal indicates location of heat flow meters.

Fig. 12—Heat flow and temperature distribution for south half of Environment Laboratory

Simulated room conditions, no furnishings

floor and east wall plus convection loss to the cooler air. The last column of Table 5 gives the magnitude of the calculated net radiant energy exchange between any one surface and the rest of the room. This is expressed as a percentage of the calculated total radiant output of the ceiling. If reflections are neglected, these fractions hold for any emissivity and the differences between them and the measured heat flow, expressed as a percentage of measured ceiling heat flow, are accounted for by convection exchange with the air.

These percentages show that the east wall received energy both by convection from the air and in the net radiation exchange with the other surfaces. However, both the floor and the neutral surfaces lost heat to the air by convection and at the same time gained heat in the net radiant exchange with the other surfaces. Moreover, the convection loss from the three neutral walls is just balanced by the radiation exchange, since the net heat flow through these surfaces is practically zero.

It will be noted that in Fig. 11 heat flows into the room from the lower part of the neutral surfaces and out from the room through the upper part. The temperature distribution over the neutral surfaces is roughly what might be expected for inside walls of a normal room.

As previously shown in Table 4 the heat flow rates from a ceiling in a non-uniform environment were not greatly different from the heat flow rates that would be found in a uniform environment with the same AUST. By contrast the air temperatures are found to be different. This is illustrated by Table 6 for three different tests. Fig. 6 shows the effect of the non-uniform environment on the air temperature gradient for two different tests. In one case the gradient is quite similar to that for a uniform surrounding, while in the other, the gradient is markedly different. Further investigation of non-uniform environments is planned.

Effect of Room Furnishings

The air temperatures, as found in the tests with a uniform environment, were felt to be much lower than normally experienced in practical installations. It might be expected that normal room furnishings would have some effect on the air temperature. To explore this possibility, several tests were made in which sheets of rigid insulation board were placed in the room to provide additional surface area such as would be provided by room furnishings. Four foot high sheets were set vertically, parallel to the four walls, 2-½ ft from the walls with about 1-½ in. between the floor and the bottom edges of the sheets. The sheets formed a continuous hollow rectangular enclosure with an opening of 18 in. for access.

This arrangement caused an increase in air temperature of about 5 deg for 120 F ceiling and 65 F AUST, both without infiltration and with two air changes at zero and 40 F. The ceiling output was reduced slightly, the heat flow through the floor was decreased and all the walls showed an increase in heat flow.

The effect of room furnishings was still further explored in a series of tests with non-uniform environment and with living room furniture. The east and south walls were cooled to simulate the outside walls of the room. Three 4 ft by 5 ft panels in these walls, two in the east wall and one in the south wall, were chilled to a still lower temperature to simulate windows. The other two walls and the floor were neutral and the air temperature back of these areas was held at about 65 F. In this series of tests the temperatures of the simulated cold walls and glass were held constant while the ceiling

temperature was adjusted until the room air temperature at 60-in. level was substantially 70 F. Tests were made as follows:

A. Non-uniform environment, empty room,
B. Non-uniform environment with furniture,
C. Non-uniform environment with furniture and lights (900 watts),
D. Non-uniform environment, with furniture, lights (900 watts) and drapes covering the simulated windows.

In each case tests were made without infiltration and with one air change at 20 F outside temperature. The furniture consisted of a settee, five upholstered chairs, one large table, two end tables, two torch-type floor lamps, and one table lamp.

Tests were first conducted on the empty room as previously described. Fig. 12 shows the temperature and heat flow rate distribution for the empty room without infiltration. The effect of the cold windows on the heat flow through the wall sections below them will be evident.

The relationship of these test conditions to practical situations can best be shown by an illustration. Assume that the outside air temperature is 20 F for the conditions shown in Fig. 12. For the average of the heat flows shown for the *glass*, the window conductance (inside glass surface to outside air temperature) is 4.3 Btu per (hr) (sq ft) (F deg). This corresponds to an overall coefficient, air-to-air, U of 1.19 Btu per (hr) (sq ft) (F deg) when the commonly used inside coefficient of 1.65 Btu per (hr) (sq ft) (F deg) is applied. On the same basis the south wall has a U value of 0.14 and the east wall a U value of 0.16.

The ceiling temperatures required to maintain approximately 70 F room air temperature and the corresponding heat flow rates are given in Table 7. Also listed are the AUST values. As furniture, lights, and drapes hung over the windows were progressively added, the ceiling temperature required, and the accompanying heat flow rate, were reduced. A change in AUST will be noted. This reflects the change in temperature of the neutral floor and the two neutral walls as the test conditions were changed.

Some indication can now be given as to the extent to which ceiling panel performance in a uniform environment differs from the performance of a panel in a normally furnished room of non-uniform environment. In Table 7 panel output and room air temperature for each of the eight tests are compared with the estimated values for an empty room with a uniform environment which has the same AUST and the same ceiling temperature. These values were taken from Figs. 1 and 4. The heat flow in the A tests is very nearly the same as the heat flow for a uniform environment. This was also observed in other tests (see

Table 5—Heat Flow Distribution for Non-Uniform Environment Without Infiltration
Test No. 26 (AUST: 59.9 F)
Air Temperature at Center of Room: 58.6 F at 30-inch level; 66.3 F at 60-inch level

Surface	Surface Temp F	Total Heat Flow Btu/hr	Percentage of Ceiling Heat Flow	Heat Flow Btu/(hr) (sq ft)	Angle[a] Factor	Percentage[b] Radiant Energy Exchange
Ceiling	129.1	23,080	100.0	76.7		100.0
Floor	63.0	6,290	27.2	20.9	0.425	38.9
North (incl. door)	N 74.2	10	0.0	0.1	0.090	5.0
South	N 73.7	75	0.3	0.8	0.090	5.1
West	N 73.4	150	0.7	0.8	0.197	7.0
East	27.8	15,620	67.7	79.7	0.197	48.0
Total: Walls and Floor		22,145	95.9			
Unaccounted for		—955	—4.1			

[a]A geometrical factor which takes into account both the shape and the relative position of the surfaces. It represents, as a fraction, the radiant energy emitted from the ceiling which is intercepted by each surface, with no allowance made for reflections. See Reference 4.
[b]This is the calculated net radiant energy exchange between each surface and the rest of the room. Calculation based on emissivity = 1.0.
[c]Neutral surface (neither heated nor cooled).

Table 6—Effect of Non-Uniform Environment on Room Air Temperature with No Infiltration

Test No.	Ceiling	Room Surface Temperatures, Fahr.				Room Air Temperatures F Deg at 30- and 60-in. levels			
		AUST	Floor	Glass (East) (Wall)	Other Walls	Non-Uniform		Uniform	
						30-in.	60-in.	30-in.	60-in.
26	129.1	59.9	63.0	27.8	N 73.8	58.6	66.3	62.6	65.4
27	110.9	57.5	63.3	27.2	N 68.3	57.8	62.9	59.6	61.8
28	142.1	63.9	65.1	33.0	N 78.6	62.2	71.1	66.9	70.1

[a]Neutral surface (neither heated nor cooled).

Table 7—Heat Flow Rates and Air Temperatures for a Room with Non-Uniform Environment Compared with Values for an Empty Room with Uniform Environment

Test Condition	Test No.	Ceiling Temp. F	AUST F	Ceiling Heat Flow Btu/(hr) (sq ft)	Room Air Temp. at 60 in. level F
With No Infiltration					
A	115	89.5	68.4	21.2	71.2
Uniform[a]		89.5	68.4	22.0	70.0
B	124	88.3	66.8	20.9	70.4
Uniform[a]		88.3	66.8	22.0	68.6
C	118	83.5	67.0	11.5	70.0
Uniform[a]		83.5	67.0	16.5	68.5
D	120	82.7	67.3	8.5	70.0
Uniform[a]		82.7	67.3	15.5	68.5
With One Air Change at 20 F					
A	116	106.7	70.7	39.9	70.9
Uniform[a]		106.7	70.7	40.8	70.4
B	123	101.7	67.9	35.5	70.2
Uniform[a]		101.7	67.9	36.6	67.6
C	117	97.1	68.9	24.9	70.2
Uniform[a]		97.1	68.9	30.3	68.1
D	119	93.9	68.3	20.5	70.2
Uniform[a]		93.9	68.3	27.1	67.2

A—Non-Uniform Environment, Empty Room.
B—Non-Uniform Environment, Furniture.
C—Non-Uniform Environment, Furniture and Lights (900 watts).
D—Non-Uniform Environment, Furniture, Lights (900 watts) and Drapes.
[a]Uniform Environment, Empty Room (Estimated).

The Officers, Council, and Staff
Wish the Members and Friends
of
ASHVE
A Very Merry Christmas
and
A Prosperous and Happy New Year

FIFTY-YEAR INDEX TO ASTM TECHNICAL PAPERS

The *American Society for Testing Materials* has recently issued a *Fifty-Year Index to ASTM Technical Papers and Reports*. This index gives proceedings of the Society from 1898 to 1950. The index is intended to make readily available to the materials technologist, the researcher, the engineer, and others, pertinent information on a particular subject. The index includes technical papers which have appeared in Proceedings, *ASTM Bulletins*, Special Technical Publications, or special compilations of standards. Copies of this 216-page book can be procured from *ASTM* headquarters, 1916 Race St., Philadelphia 3, Pa., at $6.00 a copy.

Table 4). The results of the B tests in which furniture was added show little change in this relationship even though the furniture shields some surfaces from the ceiling panel. In the C tests the heat outputs were substantially lower because of the addition of lights, the heat input from which amounted to about 10 Btu per (hr) (sq ft of ceiling area). It should be noted that the difference in panel outputs, compared to the corresponding uniform environment values, is only about one half of the energy input from the lamps. The addition of drapes over the windows caused a somewhat greater difference between heat flows in the D tests and the corresponding uniform environment values.

In each case the estimated room air temperature is lower for the empty room with uniform environment than the observed value in the tests with non-uniform environment and furniture. The values were taken from Figs. 7 and 9.

Summary

The air temperatures and heat flow rates which have been given in this paper pertain only to the room in which the investigation was made. The greatest part of the investigation has dealt with a uniform temperature environment with the entire ceiling heated. The effects of many important variables remain to be studied. On some of these, such as room furnishings, a limited amount of work has been done. But also to be considered are the effects of occupancy, points of entrance and exit of infiltration air and the effects of non-uniformity of temperature of actual exposed walls.

The effect of room size on panel performance has not been investigated. The construction of the Environment Laboratory is such that ceiling height can readily be changed and that two smaller rooms can be made from the present large one. The many possible room dimensions that the designer may encounter suggest that a simple approach may be through evaluation of the convective and radiant modes of heat transfer.

However, *for this room and the specific test conditions reported here* the following observations can be made:

1. The total heat output of the ceiling panel was much lower than is given in some presently used design methods. This seems to be due principally to the fact that the convection conductances obtained for the ceiling panel appear to be much lower than presently published data would indicate.

2. The heat flow due to radiant exchange between a given surface and the rest of the room may be opposite in direction to the heat flow due to the convective exchange between the surface and the ambient air.

3. The surface temperatures of neutral walls were not necessarily the same as the temperature of the ambient air but were dependent upon the heat balance between the radiative and convective heat exchanges.

4. For this room, a definite relationship was established between room surface temperatures, infiltration air rate and temperature, and the temperature of the room air at the 60 in. level.

5. With no infiltration the AST minus the room air temperature was directly proportional to the ceiling temperature minus the AUST. For constant values of ceiling temperature and AUST, the difference between the AST and room air temperature increased as the rate of infiltration increased and as the temperature of the infiltration air decreased. As defined before, the AST is the area-weighted average temperature of *all* the room surfaces, and the AUST is the area-weighted average temperature of the *unheated* surfaces of the room.

References

1. The ASHVE Environment Laboratory, by Cyril Tasker, C. M. Humphreys, G. V. Parmelee and L. F. Schutrum (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, March 1952, p. 119).

2. A Low-Inertia Low-Resistance Heat Flow Meter, by R. G. Huebscher, L. F. Schutrum, and G. V. Parmelee (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, May 1952, p. 111).

3. A Simple Heated-Thermocouple Anemometer, by H. B. Nottage (ASHVE JOURNAL SECTION, *Heating, Piping & Air Conditioning*, September 1950, p. 146).

4. *Panel Heating and Cooling Analysis*, by B. F. Raber and F. W. Hutchinson (John Wiley and Sons, Inc., New York, 1947).

Chicago Ready for Largest Society Meeting and Exposition

The Conrad Hilton Hotel **January 26-29, 1953**

THE members of Illinois Chapter will be hosts in January for the 59th Annual Meeting — the tenth time since the Society's founding. The 1953 meeting, now only a month hence, promises to surpass the last previous high in meeting attendance established in 1949, when over 2,500 members, guests and ladies registered in Chicago.

The program for the 59th Annual Meeting includes papers to be presented at the six technical sessions dealing with physiological reactions of men and women to sudden environmental changes, calculating friction heads for pipe lines, measuring air and water flow in testing vacuum pump lines, odor control, fuel consumption, heat from chimneys, pressure and friction losses in ducts and fittings, studies on floor panel control systems, room air distribution, heat exchanges in a panel heated room, shading of sunlit glass, and compression tank sizing.

Papers on downward travel of heated jets from nozzles, velocities in jets, and summer cooling of the residence will conclude the technical program.

W. A. Kuechenberg, general chairman, and G. W. Bornquist, vice chairman have announced the entertainment highlights of the program.

On Monday night there will be an informal party and get-together in the Grand Ballroom of the Conrad Hilton Hotel with dancing, entertainment and a floor show. On Wednesday, January 28 the Annual Banquet will be held in the Conrad Hilton's Grand Ballroom with C. M. Burnam, Jr., acting as toastmaster and Nathaniel Leverone, Chicago, as the speaker.

A full round of ladies' activities is scheduled. There will be a luncheon and miniature grand opera, in addition to a tea and drama program on both Monday and Wednesday afternoons. On Tuesday afternoon a tea and style show will take place at Marshall Field & Co.

Reservation request forms for the special events have been mailed to all members, and early reservations are advised. These forms should be mailed directly to G. W. Bornquist, vice chairman, Committee on Arrangements, Illinois Chapter, ASHVE, 605 West Washington Blvd., Chicago 6, Ill.

Exposition to be Largest Ever

The 11th International Heating, Ventilating and Air Conditioning Exposition which will be in conjunction with the Society's Annual Meeting will be held at the International Amphitheatre and Chicago Convention Building and will be the largest exposition of its kind in history.

C. F. Roth, president of the International Exposition Co., New York, managers of the Exposition, has announced that the demand for space has far exceeded previous expositions, and the forthcoming event will include nearly 400 displays of the leading manufacturers of industrial, as well as domestic and commercial applications of heating and air conditioning equipment. A very large proportion of exhibits will be displayed by manufacturers of complete heating, ventilating and air conditioning systems. The emphasis on domestic heating and hot water supply systems, as usual, will be very heavy.

Within the Amphitheatre will also be exhibited a considerable variety of complementary items, such as equipment and tools for use in installing heating and ventilating equipment, special fixtures, fastenings, insulation, etc.

Equipment of Interest to Manufacturers

Exemplifying collateral services such as the air conditioning industry provides for industrial users in many different forms is an oil mist precipitator which has been developed. An

The John G. Shedd Aquarium

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Banquet

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Plant Inspection

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Chairman
Publicity

Sunday—January 25

10:00 a.m. REGISTRATION

Council and Committee Meetings

Monday—January 26

9:00 a.m. REGISTRATION (Conrad Hilton Hotel)

9:30 a.m. FIRST TECHNICAL SESSION (Conrad Hilton Hotel)

Call to Order

Welcome to Chicago

Greetings by M. W. Bishop, President, Illinois Chapter

Response by Pres. Ernest Szekely

Reports of Officers and Council

A Comparison of Physiological Adjustments of Clothed Women and Men to Sudden Changes in Environment, by Tohru Inouye, F. K. Hick, M.D., R. W. Keeton, M.D., J. Losch, Nathaniel Glickman

Two Methods of Calculating Friction Heads for Pipe Lines, by F. E. Giesecke

Address: Dr. Preston Bradley, Pastor of People's Church of Chicago

Subject: "Today — Tomorrow and You"

12:30 p.m. Council Luncheon (Saddle and Sirloin Club)

2:00 p.m. EXPOSITION — Opening of 11th International Heating, Ventilating and Air Conditioning Exposition (International Amphitheatre and Chicago Convention Building). Exposition will open daily from 12 noon to 10:00 p.m., Tuesday to Thursday, and will close at 6:00 p.m. on Friday. ASHVE Booth —No. 325.

Tuesday—January 27

9:00 a.m. REGISTRATION (Conrad Hilton Hotel)

9:30 a.m. SECOND TECHNICAL SESSION (Conrad Hilton Hotel)

Report of Tellers of Elections

Compression Tank Sizing, by H. A. Lockhart and G. F. Carlson

The Bacteria and Odor Control Problem in Occupied Spaces, by R. L. Kuehner

Heat Transmitted to the I-B-R Research Home from the Inside Chimney, by W. S. Harris and R. J. Martin

Fuel Consumption Analysis for Multi-Family Housing Projects, by Rutcher Skagerberg and J. E. Phifer

2:30 p.m. THIRD TECHNICAL SESSION (Conrad Hilton Hotel)

RESEARCH ADMINISTRATION SYMPOSIUM

Participation by Colleges in Research, by E. A. Walker

Industrial Research in the Control of Environment, by W. H. Kliever

Government Sponsored Research — A Canadian View, by R. F. Legget

G. V. Zintel
Secretary
Illinois Chapter

S. R. Lewis
Honorary Chairman

H. M. Hart
Honorary Chairman

A. C. Willard
Honorary Chairman

59TH ANNUAL MEETING

Wednesday—January 28

9:00 a.m. REGISTRATION (Conrad Hilton Hotel)

9:30 a.m. FOURTH TECHNICAL SESSION (Conrad Hilton Hotel)

Friction Losses in Round Aluminum Ducts, by F. W. Hutchinson

Pressure Losses in 4-Inch Diameter Galvanized Metal Duct and Fittings, by H. G. Conn, W. G. Colborne, and W. G. Brown

Pressure Loss Characteristics of Small Diameter Round Duct Systems, by G. R. Whitnah and J. V. Borry

Room Air Distribution Research for the Improvement of Year 'Round Air Conditioning — Part I, by S. F. Gilman, H. E. Straub, A. E. Hersbey, and R. B. Engdahl

2:30 p.m. FIFTH TECHNICAL SESSION (Conrad Hilton Hotel)

Report of Committee on Research, by I. W. Cotton, Chairman

Field Studies of Floor Panel Control Systems, by A. B. Algren, E. F. Snyder, Jr., and J. S. Locke

Heat Exchanges in a Ceiling Panel Heated Room, by L. F. Schutrum, G. V. Parmelee, and C. M. Humphreys

The Shading of Sunlit Glass — An Experimental Study of Slat-Type Sun Shades, by G. V. Parmelee, W. W. Aubele, and D. J. Vild

7:00 p.m. ANNUAL BANQUET (Conrad Hilton Hotel)

Toastmaster: C. M. Burnam, Jr.

Speaker: Nathaniel Leverone, Chairman of Board, Automatic Canteen Co. of America

Subject: "This Freedom of Ours"

Presentation of Past President's Emblem to Ernest Szekely, Milwaukee

Presentation of F. Paul Anderson Medal to Everett N. McDonnell, Chicago

Thursday—January 29

9:00 a.m. REGISTRATION (Conrad Hilton Hotel)

9:30 a.m. SIXTH TECHNICAL SESSION (Conrad Hilton Hotel)

Maximum Downward Travel of Heated Jets from Standard Long Radius *ASME* Nozzles, by Linn Helander, Shee-Mang-Yen, and R. E. Crank

Air Velocities in Ventilating Jets, by G. L. Tuve

Summer Cooling in Research Residence No. 2 at University of Illinois — 1952, by H. T. Gilkey, D. R. Bahnfleth, and R. W. Roose

Installation of Officers

Unfinished Business

New Business

Resolutions

Adjournment

1:30 p.m. Council Meeting

H. G. Gragg
Chairman
Reception

J. S. Kearney
Chairman
Entertainment

G. G. Freyder
Chairman
Finance

J. F. Cummiskey
Chairman
Sessions

Mrs. G. W. Bornquist
Ladies

International Amphitheatre and Chicago Convention Bldg. with Stock Yards Inn at left

item in the line of liquid filtration is an oil-burner model water filter designed for attachment to the supply line of any steam or hot water boiler.

Typical of a considerable number of exhibits is a line consisting of a complete series of low pressure steel heating and hot water supply boilers fired interchangeably by oil or gas, and equipped as standard or packaged units. Topping this line is a new series of competitively-priced packaged boiler-burner units, pre-wired, accessory equipped and ready to be set in place and connected.

Of interest to architects and building contractors in the residential field is a compact single packaged combination heating and cooling unit which is easily adaptable to duct work. Another packaged air conditioning unit has an adaptable feature which should make it of considerable interest to contractors. It is a compact, free standing unit having an interchangeable top or bonnet construction, making it suitable for domestic or commercial installations.

Among other innovations at the exposition will be a table top oil fired domestic hot water heater with tankless coils. A flame failure safeguard, made with a photo-conductive cell, adapted for use with conversion burners will be shown.

An exhibit will demonstrate the sensitivity of electronic control and show how such equipment is being used in the heating industry. In this system the outdoor and indoor control elements are so related that either one alone, or the differential between the two, may turn the heat source on or off.

There will be displays of centrifugal motor-pumps with mechanical seals and showings of new type compressors. Booster fans for duct work, along with direct and belt drive fans, and pedestal type man and product cooler fans will be shown.

A pilot pressure regulator to control operating pressure on gas pilot flames of tamperproof design is of interest; and packless joints for a wide variety of applications will be featured. New uses for acoustical insulation will be one of the highlights of the show.

Large numbers of new tools are scheduled, including methods of anchoring fasteners in concrete by means of the energy of a blank cartridge discharge; mechanical and hydraulic pipe benders; woodboring tools, augur bits, chisels, punches.

ASHVE Booth

An important feature of the Exposition will be the display of the research activities of the ASHVE in the center of the second floor in the North Wing of the Amphitheatre. In this exhibit a dynamic demonstration of the physiological effects of rapid change from a warm to cool space will be presented. There will also be a showing of the ASHVE heat meter, the effect of shading on cooling load, and radiation effects.

Bus Service from Hotels to Amphitheatre Planned

Regular bus service between the downtown hotels and the Amphitheatre will be provided by the Gray Line. Rates will be same as for 1949 Exposition, 40 cents one-way and 75 cents round-trip tickets.

Thirty-minute service will be provided, starting from the State St. entrance of the Palmer House, with stops at the Michigan Ave. entrance of The Congress, the Michigan Ave. entrance of The Blackstone, and the 8th St. entrance of The Conrad Hilton. Bus service will start from the Palmer House at 11:00 a.m. and the last trip will leave the Amphitheatre at 10:15 p.m.

State Street, looking north from Madison Street

ASHVE Plans Research Program for 1953

By I. W. Cotton, Chairman, Committee on Research

THE ASHVE Council has approved a budget for research activities in the Society's 1953 fiscal period calling for expenditures totalling $177,450. This research program was developed in cooperation with the 18 Technical Advisory Committees and was adopted by the Committee on Research.

New projects at the ASHVE's Research Laboratory in Cleveland and at universities and colleges able and willing to cooperate with the Society in its fundamental research work are planned, with continuation of Laboratory and cooperative projects under way for the last two or three years.

Panel Heating, Cooling Results

The largest program for the Cleveland Laboratory comprises the studies on panel heating and cooling. At the Society's 59th Annual Meeting in Chicago next month, results obtained during 1952 in the Environment Laboratory, using ceiling panels, will be reported. The studies are continuing with floor panels, as well as experimental investigations of heat flow in plaster panels.

The 1953 program includes tests designed to show the effect of differences in surrounding conditions — and the size and shape of the room — on the heat transfer from both ceiling and floor panels.

Field studies on the "control" of panel heating systems are continuing at the University of Minnesota. A first report will be presented at the Chicago meeting.

Shading of Glass

The program under way for over seven years on Heat Flow Through Glass will be completed next year. Pages now in preparation will give additional results from experimental work in 1952 and earlier years.

A bulletin covering Part III of the study on Heat Transmission Through Glass is also planned, as much valuable information developed during this work has not yet been published. Of most immediate practical interest will be the development of "design data" on the shading of sunlit glass.

Heat Flow Through Roofs

The equipment used in the solar radiation studies will be modified in 1953 for studies on periodic heat flow through roof sections. Experimental determinations of heat flow through typical composite roof sections will be made to demonstrate the relationship between the mathematical solutions, developed by Prof. C. O. Mackey and others, and experimentally determined heat flow rates. These studies will be a major responsibility of the TAC on Cooling Load with the TAC on Heat Flow Through Glass cooperating.

The first steps in the development of an air conditioning "thermal circuit" were undertaken at the Laboratory late in 1951. A paper reporting the results of preliminary studies made this year is now being prepared. The project will be maintained as a "sustaining activity" during 1953 and made a major project in 1954.

New Odor Test Rooms

The new odor test rooms at the Laboratory in Cleveland will soon be ready for operation and will consist of two completely air conditioned rooms, with a central corridor separately conditioned. This facility, though primarily designed for studies on the effect of the physical characteristics of the environment on odor perception and treatment, will lend itself to a variety of other studies requiring controlled environments.

Building Materials Data Reviewed

A new project having as its main objective the compilation of up-to-date information on the thermal properties of modern building and insulating materials has recently been started at the Laboratory.

Navy Calorimeter Nears Completion

The Human Calorimeter for the Bureau of Medicine and Surgery of the Department of the Navy will be completed by next spring, at which time it will be moved to the Naval Medical Research Institute at Bethesda, Md., and set up under the supervision of a member of the Laboratory staff.

Among the many interesting developments during this work was the low-inertia, low-resistance heat-flow meter which has already found a wide application in other Society research and in work in other laboratories.

Air Distribution Studies Important

The TAC on Air Distribution, after carefully evaluating past work by the Society on air distribution and duct friction, recommended that "present programs involving both research and application engineering should be prosecuted at an early date in both these technological areas and that both phases are of great importance to the membership of the Society."

The program for 1953 calls for continuation of cooperative work at Case Institute of Technology, Kansas State College, Michigan State College, and the reactivation of experimental studies on ventilation jets at the Research Laboratory in the latter half of the year, as well as possible participation by other qualified institutions.

Other Active Projects

"Hot Water and Steam Heating:" Three studies on Hot Water and Steam Heating will be continued during 1953 — two at Northwestern University, covering noise in piping systems and the study of the meta-stable state in heating boilers, and the third at the University of Florida dealing with air entrainment in hot water heating systems. These studies have received steady industry support.

"Physiological Research:" The Society will continue to support physiological research at the College of Medicine, University of Illinois, with the cooperation of the "National Institutes of Health," and "U.S. Public Health Service."

"Sound and Vibration Control:" The TAC has recommended that studies be made of the noise characteristics of centrifugal and axial fans coupled to a duct system. The budget provides for the development of either a Laboratory project or a cooperative research project during 1953.

"Sorption:" With the very active support of the sorption industry, a two-year research fellowship has been established at Pennsylvania State College to cover studies of the dynamic characteristics of solid adsorbents.

"Industrial Environment:" The research fellowship at the University of Pittsburgh on the development of basic design information for local exhaust ventilation will be continued during 1953. The TAC on Industrial Environment was reorganized during the current year to cover a wider field of interest.

"Combustion:" The budget includes provision for studies on "flame pulsation in oil burners" and the TAC is exploring possible locations for this work.

"Heating Load:" Studies are continuing at the National Bureau of Standards on infiltration or rate of air change in rooms. Similar studies are also planned for the University of Illinois during the 1953-54 heating season. The Committee on Research is cooperating with the ASHVE's Indiana Chapter in studies of the rate of steam consumption in buildings as affected by daily variations in weather conditions.

The "TAC on Air Cleaning" is continuing its efforts to develop a satisfactory and acceptable testing and rating code for air cleaning devices used in general ventilation.

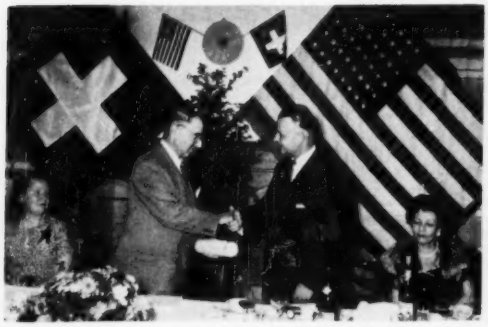
Under the "TAC on the Heat Pump," cooperative research work will continue at the University of Minnesota on the use of "solar energy" as a heat source for the heat pump.

The studies at the California Institute of Technology on the role of air conditions in "plant growth," "plant reproduction" and "photosynthesis," will be concluded at the end of 1952. The "TAC on Heating and Air Conditioning as Related to Plant and Animal Husbandry" will concentrate on translating the results obtained to date into the type of information that may be of value to heating and air conditioning engineers engaged in the design of systems for greenhouses, etc.

Your Advice is Asked

Expressions of membership interest in the various programs under the Committee on Research are to be solicited by a questionnaire, which accompanies 1953 Dues Statements.

The Committee hopes that every member will complete the copy sent to him and mail it back by December 31, so that future programs may benefit from an expression of interest from each member whose participation makes ASHVE research possible.



Alfred J. Offner, past president of ASHVE, presenting Special Branch Charter to Leo de Bruyn, president of Swiss Special Branch

Charter Meeting of Swiss Special Branch held September 5, with Past President and Mrs. Alfred J. Offner (standing in center) as honored guests

A. J. OFFNER PRESENTS CHARTER TO SWISS CHAPTER

Friday, September 5 marked a significant milestone in ASHVE history. On this date, at the Hotel Handeck, Oberhasli Tal, Grimsel, (Berner, Oberland) Switzerland, the charter meeting of the Swiss Special Branch, ASHVE was held. The charter group, composed of 19 members of ASHVE, held a day long round of activities including a trip through the hydropower installations of the Oberhasli Power Co., concluding with a dinner at the Hotel Kurhaus Handeck.

The dinner was highlighted by the presence of Past President and Mrs. Alfred J. Offner. Mr. Offner presented the charter to Leo deBruyn, president of the new special branch. The other officers of the new branch are Walter Sennhauser, vice president; Walter Hausler, secretary; and Dr. John Frei, treasurer.

STEAM HEATING AND CENTRIFUGAL FANS HIGHLIGHTED AT ST. LOUIS CHAPTER MEETINGS

Vice Pres. H. C. Sharp introduced the speaker of the evening L. C. Smith, special representative of C. A. Dunham Co., who spoke on the subject *Steam Heating System Design and Control*. Mr. Smith gave an interesting presentation on several different types of steam heating systems, with particular emphasis on high vacuum systems and the metrosystem.

The October meeting of the St. Louis Chapter was presided over by C. H. Burnap. Following the report of E. T. Clucas, treasurer, Bruce Evans, member of the Society's Council, gave a report on the October Council meeting. The attention of the Chapter was called to the article in the October JOURNAL entitled *Design Factors for Vacuum Cleaning and High Pressure Pneumatic Conveying Systems*, by K. J. Caplan of the St. Louis Chapter, co-author of the article.

Following a short question and answer period, the meeting was adjourned. Attendance 52.

At the September meeting of the St. Louis Chapter, E. E. Trickler, vice president in charge of engineering and sales for the New York

St. Louis Chapter Officers get together with speaker at October meeting. (*l. to r.*) L. C. Smith, speaker of evening, H. C. Sharp, 1st vice president, and C. H. Burnap, president

St. Louis members and Guest Speaker at September meeting. (*l. to r.*) H. C. Sharp, H. J. Kipp, E. E. Trickler, speaker, and H. Bland

Blower Co., Chicago, was the guest speaker. His subject was *Fundamental Characteristics of Centrifugal Fans.*

Slides were used to illustrate the main points of his lecture and a very interesting comparison of the three principal types of centrifugal fans was made by showing performance curves of each type. Mr. Trickler showed that each type has its place, namely: (1) the paddle wheel for a wide operating range at low efficiency and particularly suited to material handling because of its self-cleaning characteristics; (2) the forward curved-blade type filled a need for a fan with medium efficiency in a limited operating range and where low speed is desirable — it required careful selection to give its best performance; and (3) the backwardly inclined-blade type is the most popular for heating and ventilating purposes because of its high efficiency, flexibility of performance and non-overloading characteristics.

A lengthy question and answer period followed indicating that the speaker had created much interest on the part of the audience.

Prior to the talk the business meeting was presided over by Pres. C. H. Burnap. Several committee reports were presented, and it was voted that the treasurer purchase a "J" series bond in the amount of $500. G. W. F. Myers and L. L. Hamig who attended the Semi-Annual Meeting at Spring Lake reported on the activities there. Attendance 60.

UNIT *VS.* CENTRAL SYSTEMS FOR SCHOOLROOM HEATING AND VENTILATING

Henry Wright, Moline, Ill.

S. A. Baird, Peoria, Ill.

For the heating and ventilating of schoolrooms, are unit ventilators or central systems the most suitable? Illinois Chapter members of the Society recently heard both sides of this question discussed at the first Chapter meeting of the 1952-53 season, October 13.

Henry Wright, technical consultant for Herman Nelson Products, American Air Filter Co., Moline, Ill., discussed the modern unit ventilator and described its functions. He emphasized the fact that the principal problem in a modern schoolroom is often one of cooling, even in relatively cold weather, because of solar heat gain, heat from lights, the occupants, etc.

In Mr. Wright's opinion, it is important that the heating equipment have sufficient capacity to bring unused rooms up to their proper temperature quickly — for example, rooms which are permitted to cool during weekends. In addition to providing ventilation or outside air as specified by laws, the unit ventilator must introduce large amounts of air for cooling, and Mr. Wright indicated that air discharge temperatures range from 55 to 150 F.

The advantages of the central system were described by S. Alan Baird, consulting engineer of Peoria, Ill., who began his talk by tracing the history and development of central heating and ventilating systems for schoolhouses and who agreed that the early systems were unsatisfactory. In his opinion, the modern control system is not only satisfactory but the best way to heat and ventilate classrooms. Such a system, he said, should have enough radiation to take care of all heating requirements and should have modulating controls.

In speaking of the various advantages which the central system provides, Mr. Baird said that the installation cost is no greater than that for a unit ventilator system, and that power costs are no greater and frequently less. Weekend heating was described as a simple matter because only the radiation need be used. It was pointed out that there were fewer controls to service and maintain and that maintenance work (such as oiling, cleaning filters, etc.) is centralized. Other advantages which were cited include the location of outside air intakes well above the ground, the relative ease with which electrostatic air filters may be incorporated in the system, and the ease with which small spaces, such as offices and vestibules, may be ventilated.

Attention!!
Members of ASHVE
Moved or Moving?

Each month mail is returned BECAUSE you overlooked advising us of the change in your address.

The return mail is a loss to you, and an added expense to the Society.

In your own interest, will you please advise us at once of any change in your business or home address, indicating which is your mailing address.

ASHVE Headquarters
62 Worth St.
New York 13, N. Y.

Summary of Chapter Meetings*

• *ARKANSAS*: At the September meeting of the Arkansas Chapter held at the Pike Hotel in Little Rock, a School Committee, with R. E. Blaylock as chairman, was appointed. A nominating committee was proposed, composed of J. E. Mullins, C. H. Miller, W. H. D. Grant, and Morris Benkovitz. A discussion was held on the forthcoming Annual Meeting to be held in Chicago and early reservations were urged by R. D. Elgin. Attendance 21. Attendance ratio 0.35.

• *ATLANTA*: The September meeting was a joint function with the Atlanta Section of the *American Society of Refrigerating Engineers*, held at Mammy's Shanty. A social hour and dinner preceded the business meeting.

The speaker of the evening, A. B. Newton, vice president engineering, Acme Industries, Inc., Jackson, Mich., was introduced by G. D. Guler. Mr. Newton gave an interesting and informative talk on *Heat Pumps*. A discussion period followed. Attendance 101. Attendance ratio 0.79.

• *CINCINNATI*: Henry Wright, technical consultant, Herman Nelson Products, American Air Filter Co., Inc., spoke on *Fundamentals of School Heating and Ventilating* at the October meeting of the Cincinnati Chapter. In his talk Mr. Wright described the methods and instruments used in evaluating the heating and ventilating of class rooms including the convective and radiant cooling effects of the class room windows.

During the business portion of the meeting, Pres. H. E. Russell announced the nomination of A. W. Edwards to the Council of ASHVE. A discussion of the merits of remaining at the Engineering Building for future meetings was brought up, together with that of the new model by-laws. It was moved and seconded that the new by-laws be approved and adopted. Attendance 44. Attendance ratio 0.42.

• *CONNECTICUT*: An afternoon inspection trip through the Phoenix Insurance Co. Building, enjoyed by members and guests, preceded the evening business meeting held at the Hartford Club, Hartford, on October 16. Guests of the evening included Messrs. Jansen and Wilkers, consulting engineers for the building, and the speaker of the evening, A. A. Giannini, assistant product manager, Carrier Corp., Syracuse, N. Y. Mr. Giannini spoke on the high velocity duct system using high pressure induction convectors which had been installed in the new Phoenix Insurance Building. Attendance 89.

•*CONNECTICUT*: C. H. Coogan, head of the Engineering Department, University of Connecticut, was the speaker at the September meeting. Professor Coogan presented an excellent talk on *The Engineering Manpower Situation*.

In the busines meeting that preceded the talk, a nominating committee was elected as follows: D. M. Hummel, *chairman;* R. M. Ripley; R. B. Sweet; R. C. Murphy; and A. J. Lawless. Attendance 60.

• *EMPIRE STATE CAPITAL*: R. B. Taylor introduced the speaker at the October meeting, Arthur Sy, American District Steam Co., Inc., North Tonawanda, N. Y. Mr. Sy spoke on the *Evolution of Expansion Joints*, showing by graphic illustrations the features and limitations of these joints. The talk was followed by a short question and answer period. The meeting was called to order in the Crossroads Restaurant, and the minutes of the previous meeting and the treasurer's report were read and approved. Attendance 27.

•*GOLDEN GATE*: C. W. Nessell, account executive, Minneapolis-Honeywell Regulator Co., Chicago, Ill., was the speaker of the evening. Mr. Nessell, a member of the Field Investigating Committee of the *National Warm Air Heating and Air Conditioning Association*, presented an interesting talk, covering his experiences in the field investigating various types of warm air installations.

The October meeting was called to order by Pres. T. J. White, and minutes of the June meeting were read and approved.

A discussion was held regarding plans for holding a joint meeting with the new Sacramento Valley Chapter, after the Chapter has received its charter, and it was decided at this meeting that the Golden Gate Chapter present the new Chapter with a gavel. Attendance 90.

• *INDIANA:* J. W. Jackson, Indiana Chapter member, introduced his brother, Commander R. O. Jackson, USNR, as the speaker at the Chapter's September meeting. Commander Jackson spoke on his experiences following his recall to active duty in the Navy, with particular emphasis on the Navy's dehumidification program. Methods of dehumidification as well as methods of applying plastic films on sheet metal housing were explained. Commander Jackson stated that the dehumidifica-

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

tion program was considered a great success in maintaining our *Mothball Fleet* in ready condition.

Pres. J. T. Hardin called the meeting to order in the Construction League Building, which was followed by the reading of the May minutes by Vice Pres. R. C. Blackman. Attendance 29.

• *KANSAS CITY*: Following a short business meeting at which the various committee chairmen presented their reports, and announcements concerning future meetings of the Kansas City Chapter were made, a brief talk was given by Chester Litman from the United Funds Campaign Headquarters urging the members participation.

Program Chairman G. H. Stoffer announced the program for the November meeting as a panel of Chapter members speaking on *Perimeter Heating.*

D. M. Allen introduced the speaker, Reg F. Taylor, first vice president of the Society. Mr. Taylor, Charter member of the Kansas City Chapter of ASHVE, gave an interesting address entitled *Yesterday, Today, and Tomorrow.* He cited the many accomplishments which the Society can show over the 57 years of its existence.

After Mr. Taylor's talk, which was enjoyed by all the members, the eight past presidents of the Kansas City Chapter in attendance were introduced. Attendance 49. Attendance ratio 0.27.

• *NEW YORK*: The October meeting of the New York Chapter was highlighted by the visit of Pres. Ernest Szekely. President Szekely was introduced by J. E. Schechter, vice president and program chairman of the Chapter. His subject was *Pneumatic Conveying.*

Mr. Szekely traced the development of conveying systems employing air as the transporting medium. He explained that formulas used in design were based on experience rather than research and for that reason were empirical rules which were changed as experience grew.

The Darley system, first used to convey ash and clinker in power plants, was described. The use of 8 in. diameter pipe having elbows with replaceable backs resulted in lower maintenance costs for conveying the unburned material to railroad cars than had been obtained with other types of conveyors which were subject to serious abrasive wear and corrosion from these materials.

Types of conveying systems were shown on slides, illustrating the requirements for conveying different materials. The characteristics of the fans, collectors, separators, and other parts of the systems were discussed as they were shown on the slides.

Design data for various materials were shown on slides containing tables listing densities, suctions, velocities, etc., which were to be considered.

At the close of the talk President Szekely was given a rising vote of thanks. Many members took the opportunity for further discussion of the subject after the meeting had been adjourned.

Preceding President Szekely's talk, the program, reception, and membership committees were confirmed for the coming year. Pres. P. B. Gordon read a letter from the National Society expressing its appreciation for the $1000.00 gift presented by the New York Chapter to the Research Fund.

He announced the November 18 organization meeting for the North Jersey Chapter and reported on the Chapter's participation in the Semi-Annual Meeting at Spring Lake, N. J. Attendance 120. Attendance ratio 0.20.

• *NORTH TEXAS*: Pres. R. E. Allison called the October meeting to order in the Melrose Hotel and after a brief business session in which members were asked to contribute copies of THE GUIDE 1951 for distribution to SMU engineering students, W. E. Frost introduced the speaker.

The speaker for the evening was R. L. Patton of the Minneapolis-Honeywell Regulator Co., who spoke on *Color Graphic Control Panels.* Such control techniques, he stated, were first introduced in the petroleum industry in 1937, and their spread into the complex control problems of large modern air conditioning installations is now beginning.

The new 7,000 ton air conditioning installation at the BOP Assembly Plant of General Motors Corp. in Arlington, Tex., was described along with the intricate installations in the White House.

According to Mr. Patton, graphic control panels are economically feasible in that they increase the control system total cost by only about 10 percent, and yet in a typical job can annually save about 1½ man-years of work. The usual interesting discussion period followed this fine presentation. Attendance 88. Attendance ratio 0.60.

• *NORTH TEXAS*: Louis Throgmorton, the speaker for the September meeting of the North Texas Chapter, was introduced by F. L. Gray, Jr. Mr. Throgmorton, vice president and head of the Public Relations Department of the Republic National Life Insurance Co., Dallas, delivered an excellent address entitled *Telling vs. Selling,* carrying serious undertones but so filled with humor as to result in one of the best talks ever presented to this Chapter, according to the secretary's report.

The meeting was called to order and presided over by Pres. R. E. Allison at the Melrose Hotel. Attendance 82. Attendance ratio 0.57.

• *NORTHEASTERN OKLAHOMA*: The September meeting was held at the University of Tulsa Student Activity Building on September 9. The business meeting was brief, and it was announced that Reg F. Taylor, first vice president of ASHVE was to speak at the Chapter's October meeting.

The program featured the showing of a Kodachrome sound film produced for the Bituminous Coal Institute entitled *Powering America's Progress.* Attendance 15. Attendance ratio 0.41.

• *ONTARIO*: The Ontario Chapter was privileged to hear an address at its October meeting at the Royal York Hotel given by the Society's Second Vice President, L. N. Hunter, vice president of research, The National Radiator Co., Johnstown, Pa. His talk, *The Rating of Heating Boilers*, discussed methods currently being used for rating both cast iron and steel boilers for hand and automatic firing. Codes of both the I-B-R covering cast iron boilers and the *Steel Boiler Institute* covering steel boilers were reviewed. Principles and limitations involved in rating boilers and the meaning of different ratings concluded his talk.

During the business meeting which preceded the excellent talk by Mr. Hunter, the Chapter committee chairmen were introduced. Pres. J. H. Ross announced that Queen's University had accepted the Ontario Chapter's offer to present a $50 award to the student writing the best thesis on heating, ventilating or air conditioning. Attendance 113. Attendance ratio 0.42.

• *OREGON*: The October meeting of the Oregon Chapter was held at the Heathman Hotel in Portland and was attended by several guests from the Student Branch of Oregon State College.

B. W. Farnes presented a set of ASHVE bookends to H. W. McKenzie as past president of the Chapter.

The speaker, W. E. Gleeson, western regional manager for McDonnell-Miller of Chicago, was introduced by Chapter Vice-Pres. A. N. Hoss. Mr. Gleeson spoke on *Safety Control Methods for Hot Water and Steam Systems*. He cited many examples of failures of safety equipment and the results when no safety equipment at all was used.

At the conclusion of the talk, the business meeting was held, and reports of the various committees were presented by their respective chairmen. Attendance 72. Attendance ratio 0.53.

• *PITTSBURGH*: The October meeting of the Pittsburgh Chapter was a joint affair with the local chapter of the *ASRE*. The local officers of each of the groups were introduced, and Vice-Pres. C. H. Schneider, chairman of the program committee, announced that L. N. Hunter, second vice president of the Society and vice president of research of The National Radiator Co., Johnstown, Pa., would be the November meeting speaker.

National President Edward Simons of *ASRE* was introduced and made a few brief remarks.

The speaker, A. B. Newton, vice president engineering, Acme Industries, Inc., Jackson, Mich., was presented by Mr. Ruthrauff. Mr. Newton spoke on *Latest Developments in Water Chilling for Air Conditioning*. His talk was illustrated by slides which showed the equipment with varying sizes for different jobs and methods of control at different points.

Following a question and answer period, the meeting was adjourned. Attendance 85.

• *SHREVEPORT*: The September meeting of the Shreveport Chapter was held at the Monsours Restaurant and was presided over by Pres. R. M. Hood. During a short business meeting, the Annual Meeting in Chicago and methods of obtaining additional membership were discussed.

The Program Chairman W. S. Evans introduced R. L. Patton who in turn introduced C. D. Adams, commercial division manager, Minneapolis-Honeywell Regulator Co., Houston, Tex. Mr. Adams spoke on *Thermostatic Control of Systems for Heating and Air Conditioning for Small Residences*. Attendance 40. Attendance ratio 1.00.

• *SOUTH TEXAS*: The September meeting of the South Texas Chapter was highlighted by an address by James Neal, manager of the Dallas office of Fibre Glass Corp. who spoke on *Insulation As It Affects Air Conditioning*. Mr. Neal predicted a tremendous demand for air conditioning in the next 15 years, particularly in the home construction field. He pointed out the necessity of controlling heat flow by means of insulation. Most insulation depends upon the following factors for retarding the flow of heat: (1) trapped air; (2) heat reflective material; (3) colors having low absorption. A good method for retarding heat flow is trapping by means of cellular materials such as cork, glass, vermiculite, etc. The more surface and smaller air spaces present, the better the insulation. In insulation of cold surfaces, Mr. Neal stated that water vapor is a complicating factor, and that a vapor barrier is necessary on the warm side of the insulation to prevent flow under the influence of vapor pressure.

During the business meeting conducted by Pres. C. L. Fleming, D. M. Mills advised the members that special cars would be used for the members attending the Annual Meeting in Chicago. Attendance 45. Attendance ratio 0.34.

• *SOUTHERN CALIFORNIA*: There being no business to conduct, W. J. Biggar, program chairman, introduced E. W. Briggs of Dun and Bradstreet who gave a short coffee talk on the *Whys and Wherefores of Dun and Bradstreet*.

Mr. Biggar then presented the guest speaker, C. W. Nessell, account executive with Minneapolis-Honeywell Regulator Co. Mr. Nessell, a member of the Research Advisory Committee of the *National Warm Air Heating and Air Conditioning Association* and chairman of the Association's Field Investigation Committee, discussed the experiments and findings of this committee resulting from the operation of a mobile laboratory. This laboratory tests both new and old types of installations throughout the United States. He described several novel and effective methods of warm-air residence heating and gave data on some of the results obtained. His talk was both interesting and humorous and was followed by a short discussion. Attendance 65.

• *SOUTHERN PIEDMONT*: The Cardinal Restaurant in Charlotte,

N.C., was the scene of the fall meeting of the Southern Piedmont Chapter on September 22. During the business meeting, presided over by Pres. R. M. Warren, C. N. Witmer, program chairman, was instructed to explore the possibilities of a joint meeting to be held with the Northern Piedmont Chapter on the occasion of the visit of Ernest Szekely, president of the Society.

The speaker, C. R. Harris, president of Pneumafil Corp., Charlotte, was introduced by R. O. McGary. He spoke on *Central Station Pneumafil* in the textile industry. He described the advantages of a central station exhaust system used to rid the spinning frames in a textile mill of broken threads and fibres. A central station method rather than individual units for each spinning frame results in consequent savings and increased speeds of operation. Attendance 33.

• *SOUTHWEST TEXAS*: At the October meeting of the Chapter the speaker, F. B. Frazee, Calcasieu Lumber Co., Austin, discussed *Chilled Water Applications*. He pointed out that the trend in air conditioning is toward simplification and less engineering of installations. This was illustrated by the fact that a great percentage of the total air conditioning tonnage installed each year is represented by window units and store conditioners. He illustrated the potential for chilled water air conditioning sales as related to the number of heating systems installed in the Southwest as compared to the number of gas meters. Using the City of Austin as an example, he pointed out that according to the gas company there are only approximately 3,000 central heating systems and 8,000 floor furnaces out of some 35,000 gas meters. Figures were given to show that boiler installations are increasing more rapidly than forced warm-air furnace installations at a rate of 28 percent *vs.* 18 percent. Typical figures were given illustrating the cost of *wet heat* on a typical job as about equal in cost to forced warm air plus the installation of the gas-fired water heater.

The advantages of the chilled water system were listed as follows: (1) flexible for zone control, for switching of peak loads for serving areas; (2) ability to perform; (3) lower operating cost by virtue of ability to shift refrigerating effect within the structure; and (4) flexibility in balancing the load between spaces.

The business meeting preceded Mr. Frazee's talk. Pres. W. E. Long conducted the meeting in which new members were introduced. An auditing committee was appointed with E. E. Cravens as chairman. The Chapter discussed the establishment of a student scholarship or fellowship fund to be known as the F. E. Giesecke Fund for Air Conditioning Students. The amount involved would be approximately $500 a year to be shared by the three Texas Chapters. A committee to study this project was appointed with I. W. Wilke as chairman. Attendance 40. Attendance ratio 0.43.

• *SOUTHWEST TEXAS*: Pres. W. E. Long presided at the September meeting of the Chapter held at the Hitchin' Post in Austin. H. J. Faller presented the report of the nominating committee with the following nominations: *President*—D. E. Locher; *Vice President*—L. H. Hornor, Jr.; and *Secretary*—F. B. Frazee. Sub-committees on the various aspects of the San Antonio Code were appointed.

The meeting was highlighted by an address by A. P. Woody entitled *Gas Combustion and Controls*. Mr. Woody was introduced by James Powell.

In his talk Mr. Woody briefly outlined the development of automatic combustion controls from manual firing to fuel governors to the use of thermostatic pilots and standard pilots with flame rod safety protection, pointing out a few disadvantages of each. He pointed out as the safest all-round method of burner safety controls, the use of intermittent ignition with automatic component check wiring arrangement. He pointed out that intermittent ignition is entirely satisfactory because pilot failure during combustion is of no consequence. The speaker traced the development of power burners as largely required by desire for elimination of a high stack. He mentioned power burners as satisfactory where the boiler or furnace is designed specifically for their use, stating that forced draft burners were most satisfactory except for the chance of hot gas escapement if a furnace door should be open. He pointed out the impossibility of purging combustion chambers of raw gas with atmospheric burners, and mentioned the advisability on induced draft burners of arranging for prepurge of three furnace volumes of air before ignition. The use of slow opening gas valves was stressed. A point of caution was raised to guard against oversizing of diaphragm valves because of the amount of diaphragm lift required for proper positioning of air shutters linked to the diaphragm. Mr. Woody concluded his talk, emphasizing the fact that half automatic systems could not be tolerated and that care should be taken to cover all possibilities in considering automatic control of gas burners. Attendance 46. Attendance ratio 0.50.

• *UTAH*: Pres. D. R. Wilde presided at the October meeting of the Utah Chapter, at which several committee appointments were made. These included E. L. Baker as program chairman, G. E. Wright, Jr. as attendance committee chairman, and a nominating committee composed of J. L. Ashton, E. L. Baker, G. C. Campbell, E. V. Gritton and G. L. Soderborg, Sr.

E. L. Baker announced that the November meeting would be a joint affair with the other members of the joint engineering council, and an address by S. S. Kestler, Dean of Engineering at the University of Utah, was scheduled. The meeting concluded with a discussion of the 59th Annual Meeting of the Society to take place in Chicago in January. Attendance 15.

• *WESTERN MICHIGAN*: At the October meeting of the Chapter, Pro-

gram Chairman R. W. Mangrum introduced J. T. Anderson who spoke briefly on heating in England. This was followed by a technicolor film, *Powering America's Progress*, presented by Melvin Dadd of the Island Creek Coal Co., and produced by the March of Time for the *Bituminous Coal Institute*. The film dealt with modern methods used in mining, classifying and transporting coal together with some of its uses. Mr. Dadd supplemented the film with a talk on the proper use of coal for industrial and domestic use.

Preceding the talks, dinner was served and a short business meeting under the direction of Pres. H. R. Limbacher was held. It was announced that the next meeting would be a joint one with the *ASME* in Grand Rapids. Attendance 41.

• *WESTERN NEW YORK*: The opening meeting of the new chapter year was held on October 13 at the University Club and presided over by Pres. J. M. Quackenbush. A discussion on the proposed new by-laws was held and the members voted unanimously to adopt the recommendations of the Board of Governors and accept the new by-laws with two minor changes: (1) The Chapter office of second vice president be continued; (2) The Board of Governors continue to serve as the nominating committee. Committee chairmen were appointed as follows: reception and membership, R. E. Lang; finance, C. W. Kaupp; telephone, Q. P. Thompson; program, C. W. Stone. Mr. Kaupp was also appointed treasurer.

The highlight of the meeting was an inspection trip through the plant of Farrar and Trefts Co., led by James Magee. A live demonstration of a small oil-fired packaged boiler was a feature of the trip. A question and answer period followed the tour. Attendance 52. Attendance ratio 0.77.

STUDENT BRANCH

• *UNIVERSITY OF DETROIT*: The September meeting was held in the Engineering Building at the University. A panel discussion was held and featured the following guest speakers: Mr. Olivieri, consulting engineer for Gruen Architects; Mr. Outwater, sales engineer for The Trane Co.; Mr. Lorne, Lorne Mechanical Contractors; and R. H. Oberschulte, sales engineer for D. T. Randall & Co., and vice president of the Michigan Chapter. The panel discussed the various phases of the heating, ventilating and air conditioning business and outlined opportunities for college graduates. The discussion was followed by a question and answer period. Attendance 17. Attendance ratio 0.61.

Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month there have been 105 applications for membership, including 6 student applications and 5 reinstatements; in addition 9 advancements have been received. The names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 31, 1952, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

Note: †Reinstatement. *Non-member. △Advancement.

Alabama

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California

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KLINE, W. W., Sr. Mech. Engr., State of California, Div. of Architecture, Sacramento. REFERENCES: N. W. Downes, Carl Henderlong*, J. E. Marshall, L. A. O'Meara.

MORRISON, H. E., Mech. Engr., Travis Air Force Base. REFERENCES: H. V. Hickman, J. E. Marshall, E. C. McKinsey, F. W. Nolte.

SIMONSON, T. R., Engr., G. M. Simonson, San Francisco. REFERENCES: E. H. Goins, D. E. McLeod, G. M. Simonson, W. M. Urbain*.

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Colorado

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Connecticut

MERCURIO, P. J., Estimator, Bridgeport Pipe Engrg. Co., Bridgeport. REFERENCES: E. R. Clement, Edward Gallagher*, P. J. Lamoureux, J. O. Ostberg.

PERRIN, CARLTON P., Engr., G. R. Cummings Co., Meriden, Conn. REFERENCES: W. A. Johnson, G. F. Nieske, R. J. Pinto, Winfield Roeder.

TENNANT, W. E., Mgr., Heating Equipment Div., American Coal Co., Inc., Hartford. REFERENCES: Peter Fleury, Raymond Rawlinson*, F. L. Smith*, A. L. Wasserman.

Delaware

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Florida

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Georgia

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Kansas

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Louisiana

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JOURNAL SECTION

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Missouri

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SCHWENK, J. W., JR., Partner, Schwenk Sheet Metal Works, Kansas City. REFERENCES: D. M. Allen, J. G. Barnes, Jr., W. L. Cassell, Emil Haas, Jr.

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New Hampshire

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New Jersey

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New York

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△CORT, J. G., President, Cort Mechanical Corp., New York. REFERENCES: Bernard Leventhal, H. J. Rose, Arthur Spaet, A. D. Walker, Jr.

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France

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Students

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FENN NAMED CARRIER VICE PRESIDENT

Cloud Wampler, president of Carrier Corp., announced recently the appointment of C. V. Fenn, a member of the Society since 1945, as a vice president of the corporation. Mr. Fenn, who was previously manager of the Direct Sales Division, will continue in charge of the Division with headquarters in Syracuse.

C. V. Fenn
Syracuse, N. Y.

Immediately following graduation from Stevens Institute of Technology in 1929, Mr. Fenn joined Carrier, starting in the Construction Department. He was later placed in charge of all construction in the east and during World War II headed a special order department in Syracuse handling government contracts. From 1944 to 1949 he was in charge of Carrier's direct sales in the Atlanta District and in 1949 was named manager of the Direct Sales Division.

Also named vice president was J. M. Bickel, previously manager of the Dealer Sales Division. Mr. Bickel will remain in charge of this Division and will also be located at Syracuse.

KELAHAN APPOINTED *NAPRE* TECHNICAL EDITOR & SEC'Y.

J. R. Kelahan, Jr., San Francisco, was recently appointed technical editor of *Ice and Refrigeration* and secretary of the *National Association of Practical Refrigerating Engineers*. The announcement was made by H. T. McDermott, publisher of *Ice and Refrigeration*, and A. R. Carlson, president of the *NAPRE*.

Mr. Kelahan, a member of the Society since 1947, is affiliated with the Golden Gate Chapter. He attended Washington University, St. Louis, and supplemented his technical training with courses in engineering at the U. S. Merchant Marine Academy, U. S. Navy schools, and University of California Extension. He was commissioned a Lieutenant USNR and USMS and served on active duty in the Merchant Marine and Navy from 1938 to 1946. In 1944-45 he was an associate instructor in naval science and tactics at the Merchant Marine Academy. Mr. Kelahan holds licenses as a steam and diesel engineer.

J. R. Kelahan
San Francisco, Calif.

More recently he has served as sales engineer for Cork Insulation Co. and Mundet Cork Co., Inc.

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Research Laboratory: 7218 Euclid Ave., Cleveland 3, Ohio

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OBITUARIES

T. NAPIER ADLAM
New York, N.Y.

T. Napier Adlam, vice president and general manager of the Sarco Manufacturing Co., New York and Bethlehem, Pa., died on October 22 in Orange Memorial Hospital. Mr. Adlam was a member of the Society since 1932 and had participated actively in New York Chapter affairs.

Born on June 16, 1882, in Monkton, Ayrshire, Scotland, he attended Swindon & Bristol College. Mr. Adlam served his apprenticeship with Haden & Sons from 1898-1905, and following graduation remained with the firm as a draftsman and designer. In 1909 he was put in charge of erection work, and from 1911-15 he did research work, particularly in radiant heating, for the company. During World War I he was in charge of a munition plant; and in 1918 returned to Haden & Sons as technical adviser and later was made works superintendent. Mr. Adlam was connected with Edwards & Shaw as a consulting engineer from 1925-30, at which time he joined Sarco as chief development engineer.

Mr. Adlam, an expert on radiant heating, was a consulting engineer and wrote several articles and a textbook on radiant heating. At the third World Power Conference in 1934 he was appointed to a committee for standardization of international symbols for heating and thermodynamics.

He was also a member of the *Institution of Heating and Ventilating Engineers*, the *Institution of Patentees*, and the *Whitworth Society of Engineers*.

Surviving Mr. Adlam are his wife, Mrs. Winifred Earney Adlam, and a daughter, Mrs. John Wordelmann, to whom the Officers and Council of the Society extend their deepest sympathy.

LUTHER D. EMMERT
Chicago, Ill.

L. D. Emmert, Society member since 1919, passed away on October 30 in Chicago.

Born in 1885 in Saline, Mich., Mr. Emmert graduated from Cornell University with a degree in civil engineering. Upon graduation, he joined the Dravo Construction Co., Pittsburgh, Pa., as an engineer, and from 1912-13 was employed by the Roberts Shaeffer Co., Chicago, as an engineer and designer of coal handling apparatus. Mr. Emmert joined the Buffalo Forge Co., in the Chicago office in 1913 as a sales engineer. He was associated with that company continuously for the next 37 years, and at the time of his death was sales representative for Buffalo Forge.

Mr. Emmert was presented with a Life Membership Certificate in the Society at an Illinois Chapter meeting in October 1950.

JOHN C. WHITE
Madison, Wis.

J. C. White, Life Member of the Society, died on September 19.

Born July 11, 1868, at Pana, Christian County, Ill., Mr. White attended school there, and later supplemented his education with a course in mechanical engineering at the Chicago Athenaeum. In 1922 Mr. White was made an honorary member of Pi Tau Sigma, and in 1918 the University of Wisconsin conferred upon him an honorary mechanical engineering degree.

Mr. White was appointed state power plant engineer, State of Wisconsin, in 1915, and served in this capacity until 1944, when he retired because of his age. At this time Mr. White entered private practice in steam and mechanical engineering.

Mr. White was a member of the *American Society of Mechanical Engineers*, a charter member of the *Engineering Society of Wisconsin*, serving as its president in 1923, the *Engineers Society of Milwaukee, Wisconsin Society of Professional Engineers*, and the *National Association of Power Engineers*.

The Officers and Council of the Society extend their sympathy to Mr. White's widow, Mrs. Sara Chuse White.

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*Member of Committee on Research.

ASHVE — OFFICERS OF CHAPTERS AND BRANCHES

(51—Chapters—1 Special Branch—9 Student Branches)

Date indicates year organized; an address and no city shown signifies same city as headquarters; numeral in parentheses indicates zone.

● **ARKANSAS:** 1952. Hdqrs., Little Rock, Ark. Meets, Third Tuesday. PRESIDENT, E. N. Pettit, Jr., 904 Wallace Bldg. SECRETARY, R. E. Blaylock, 509 E. Markham St.

● **ATLANTA:** 1937. Hdqrs., Atlanta, Ga. Meets, Second Monday. PRESIDENT, F. A. Player, 2110 Peachtree Rd., N. W. SECRETARY, J. M. Lazenby, 2641 Merry Lane, N. E., (6).

● **BALTIMORE:** 1949. Hdqrs., Baltimore, Md. Meets, Third Wednesday. PRESIDENT, E. R. Kent, 2322 N. Charles St. (18). SECRETARY, A. M. Kroft, 3935 Stokes Dr. (29).

● **BRITISH COLUMBIA:** 1952. Hdqrs., Vancouver, B.C., Canada. PRESIDENT, M. E. Mincker, 1128 Burrard St. SECRETARY, D. W. Thomson, 445 Richards St.

● **CENTRAL NEW YORK:** 1944. Hdqrs., Syracuse, N. Y. Meets, Fourth Wednesday. PRESIDENT, F. E. Krell, 116 Fernwood Ave. (5). SECRETARY, H. K. Ormsby, 205 S. Townsend St. (2).

● **CENTRAL OHIO:** 1944. Hdqrs., Columbus, Ohio. Meets, Third Monday. PRESIDENT, A. D. Bogen, 330-34 E. Livingston Ave. (15). SECRETARY, J. A. Guy, 219 King Ave. (1).

● **CINCINNATI:** 1932. Hdqrs., Cincinnati, Ohio. Meets, First Tuesday. PRESIDENT, H. E. Russell, 4th & Main Sts., Box 960. SECRETARY, F. W. Wilson, 222-24 E. 14th St.

● **CONNECTICUT:** 1940. Hdqrs., New Haven, Conn. Meets, Third Thursday. PRESIDENT, T. L. Arnold, 26 Francis Ave., Hartford (6). SECRETARY, C. L. L'Hommedieu, 76 Blatchley Ave.

● **DELTA:** 1939. Hdqrs., New Orleans, La. Meets, Third Tuesday. PRESIDENT, Walter Cooke, 816 Howard Ave. (13). SECRETARY, T. J. Jenny, 1000 S. Peters St. (9).

● **EMPIRE STATE CAPITAL:** 1951. Hdqrs., Albany, N. Y. PRESIDENT, Harry Horowitz, 869 Warren St. (3). SECRETARY, R. J. Tougher, Menands Rd., Loudonville, N. Y.

● **GOLDEN GATE:** 1937. Hdqrs., San Francisco, Calif. Meets, First Thursday. PRESIDENT, T. J. White, 625 Market St. (5). SECRETARY, Eric Roberts, 417 Market St. (5).

● **ILLINOIS:** 1906. Hdqrs., Chicago, Ill. Meets, Second Monday. PRESIDENT, M. W. Bishop, Rm. 1504, 228 N. LaSalle St. (1). SECRETARY, G. V. Zintel, 1217 W. Washington Blvd. (7).

● **INDIANA:** 1943. Hdqrs., Indianapolis, Ind. Meets, Fourth Tuesday. PRESIDENT, J. T. Hardin, 720 Noble St. (2). SECRETARY, P. O. Patterson, 6300 N. Oakland Ave. (18).

● **INLAND EMPIRE:** 1950. Hdqrs., Spokane, Wash. Meets, First Friday after First Tuesday. PRESIDENT, T. P. Nau, S. 1419 Walnut (9). SECRETARY, H. A. Bickel, E. 7 Riverside Ave.

● **IOWA:** 1940. Hdqrs., Des Moines, Ia. Meets, Second Tuesday. PRESIDENT, R. H. Schnell, 1617 33rd St. (11). SECRETARY, Bowen Campbell, 1435 Casady Dr. (5).

● **KANSAS:** 1951. Meets, Tuesday after First Monday. Hdqrs., Wichita, Kan. PRESIDENT, O. P. Bullock, 254 Laura (7). SECRETARY, H. D. Speyer, 120 Ida.

● **KANSAS CITY:** 1917. Hdqrs., Kansas City, Mo. Meets, First Monday. PRESIDENT, W. A. Reichow, 1621 E. 31st St. (3). SECRETARY, J. G. Barnes, Jr., 1924 Oak St.

● **MANITOBA:** 1935. Hdqrs., Winnipeg, Man., Canada. Meets, Third Thursday. PRESIDENT, W. J. Atkinson, 812 Boyd Bldg. SECRETARY, Ernest Lambert, 93 Lombard St.

● **MASSACHUSETTS:** 1912. Hdqrs., Boston, Mass. Meets, Third Tuesday. PRESIDENT, G. B. Torrens, 15 Alden Lane, Shrewsbury. SECRETARY, G. D. Fife, Rm. 606, 79 Milk St. (9).

● **MEMPHIS:** 1944. Hdqrs., Memphis, Tenn. Meets, Third Monday. PRESIDENT, W. L. Drake, 15 N. Reese. SECRETARY, A. T. Bevil, 212 Robinson Bldg., 160 Union (3).

● **MIAMI VALLEY:** 1950. Hdqrs., Dayton, Ohio. Meets, First Wednesday. PRESIDENT, D. L. Bergman, Box 95, Riverdale Sta. (5). SECRETARY, D. E. Tullis, 743 Kiser St. (4).

● **MICHIGAN:** 1916. Hdqrs., Detroit, Mich. Meets, First Monday after 10th of month. PRESIDENT, C. A. Strand, 9117 Hamilton Ave. (2). SECRETARY, D. S. Falk, 4864 Woodward Ave. (1).

● **MINNESOTA:** 1918. Hdqrs., Minneapolis, Minn. Meets, First Monday. PRESIDENT, William Sturm, 2160 Highland Pkwy., St. Paul (5). SECRETARY, J. G. Hamm, 850 Cromwell Ave., St. Paul (4).

● **MONTREAL:** 1936. Hdqrs., Montreal, Que., Canada. Meets, Third Monday. PRESIDENT, W. G. Hole, 7035 Grand Ave. (14). SECRETARY, D. L. Lindsay, 1411 Crescent St. (25).

● **NEBRASKA:** 1940. Hdqrs., Omaha, Neb. Meets, Second Tuesday. PRESIDENT, S. W. Black, 18th & Harney Sts. SECRETARY, H. H. Ulrich, 507 City Hall (2).

● **NEW YORK:** 1911. Hdqrs., New York, N. Y. Meets, Third Monday. PRESIDENT, P. B. Gordon, 222 E. 41st St. (17). SECRETARY, Carl H. Flink, 62 Worth St. (13).

● **NORTH TEXAS:** 1938. Hdqrs., Dallas, Tex. Meets, Third Monday. PRESIDENT, P. N. Vinther, 929 Mercantile Securities Bldg. SECRETARY, J. A. Hay, 4411 Belmont Ave. (4).

● **NORTHEASTERN OKLAHOMA:** 1948. Hdqrs., Tulsa, Okla. Meets, Second Tuesday. PRESIDENT, C. H. Dollmeyer, Jr., 1533 N. New Haven Ave. (15). SECRETARY, V. W. Miles, 624 So. Boston Ave., Box 871.

● **NORTHERN OHIO:** 1916. Hdqrs., Cleveland, Ohio. Meets, Second Monday. PRESIDENT, R. E. Sherman, 570 Hanna Bldg. (15). SECRETARY, R. G. Huebscher, 7218 Euclid Ave. (3).

● **NORTHERN PIEDMONT:** 1952. Hdqrs., Greensboro, N.C. PRESIDENT: L. L. Vaughan, P.O. Box 5746, Raleigh. SECRETARY, J. W. Bunn, Jr., 2705 Lochmore Dr., Raleigh.

● **OKLAHOMA:** 1935. Hdqrs., Oklahoma City, Okla. Meets, Second Monday. PRESIDENT, W. J. Collins, Jr., 1708 Westminster Pl. SECRETARY, F. X. Loeffler, Jr., 1604 N. W. Fifth St.

● **ONTARIO:** 1922. Hdqrs., Toronto, Ont., Canada. Meets, First Monday. PRESIDENT, J. H. Ross, 1251 Yonge St. SECRETARY, H. R. Roth, 57 Bloor St., W.

● **OREGON:** 1939. Hdqrs., Portland, Ore. Meets, Thursday after First Tuesday. PRESIDENT, K. H. Hanson, 104 S.E. Seventh (14). SECRETARY, W. R. Norte, 2225 N.E. Broadway (12).

● **OTTAWA VALLEY:** 1952. Hdqrs., Ottawa, Ont., Canada. PRESIDENT, Bernard Stotesbury, 955 Somerset St. W. SECRETARY, E. J. Schoenherr, 32 Clarey Ave. (1).

● **PACIFIC NORTHWEST:** 1928. Hdqrs., Seattle, Wash. Meets, Second Tuesday. PRESIDENT, W. B. Pride, 3111 Dose Ter. (44). SECRETARY, I. L. Winsor, 105 Orcas St. (8).

● **PHILADELPHIA:** 1916. Hdqrs., Philadelphia, Pa. Meets, Second Thursday. PRESIDENT, M. E. Barnard, 12 S. 12th St. (7). SECRETARY, C. J. Lubking, 5060 Wayne Ave.

● **PITTSBURGH:** 1919. Hdqrs., Pittsburgh, Pa. Meets, Third Monday. PRESIDENT, B. B. Reilly, Fifth & Liberty Aves. (22). SECRETARY, E. H. Riesmeyer, Jr., 231-33 Water St. (22).

● **ROCKY MOUNTAIN:** 1944. Hdqrs., Denver, Colo. Meets, First Wednesday. PRESIDENT, N. H. Brickham, 2715 S. Humboldt St. (10). SECRETARY, A. S. Widdowfield, 1925 Blake St. (2).

● **SACRAMENTO VALLEY:** 1952. Hdqrs., Sacramento, Calif. PRESIDENT, L. A. O'Meara, 1400 Tenth St. SECRETARY, J. E. Marshall, 441 Pico Way (19).

● **ST. LOUIS:** 1918. Hdqrs., St. Louis, Mo. Meets, Second Tuesday. PRESIDENT, C. H. Burnap, 235 Keruish Pl., Webster Groves (19). SECRETARY, J. F. Naylor, Jr., 2335 S. Grand Ave. (4).

● **SHREVEPORT:** 1948. Hdqrs., Shreveport, La. Meets, Third Thursday. PRESIDENT, R. M. Hood, 411 Louisiana Ave. SECRETARY, M. A. Hudson, 4609 Gilbert Dr.

● **SOUTH TEXAS:** 1938. Hdqrs., Houston, Tex. Meets, Third Friday. PRESIDENT, C. L. Fleming, 809 M. & M. Bldg. SECRETARY, J. W. Holland, 245 Esperson Bldg. (2).

● **SOUTHERN CALIFORNIA:** 1930. Hdqrs., Los Angeles, Calif. Meets, First Tuesday. PRESIDENT, J. S. Earhart, 2734 Fleur Dr., San Marino (9). SECRETARY, C. D. Walz, 3600 San Pasqual St., Pasadena (10).

● **SOUTHERN PIEDMONT:** 1952. Hdqrs., Charlotte, N.C. PRESIDENT, R. M. Warren, Jr., P.O. Box 1755, Charlotte. SECRETARY, J. A. Rice, P.O. Box 1755, Charlotte.

● **SOUTHWEST TEXAS:** 1946. Hdqrs., San Antonio, Tex. Meets, Third Tuesday. PRESIDENT, W. E. Long, Dept. of Mechanical Engrg., University of Texas, Austin. SECRETARY, L. H. Hornor, Jr., 810 Insurance Bldg.

● **UTAH: 1944.** Hdqrs., Salt Lake City, Utah. Meets, Third Thursday. PRESIDENT, D. R. Wilde, 2634 S. 19th E. (1). SECRETARY, Alfred Richeda, P.O. Box 479 (9).

● **VIRGINIA:** 1946. Hdqrs., Norfolk, Va. Meets, Third Wednesday. PRESIDENT, D. F. Phillips, P. O. Box 674, Newport News. SECRETARY, H. E. Marquart, 111 W. Main St. (10).

● **WASHINGTON, D. C.:** 1935. Hdqrs., Washington, D. C. Meets, Second Wednesday. PRESIDENT, G. R. Walz, 5214 25th Pl. N., Arlington (7) Va. SECRETARY, W. C. Reamy, Jr., 17th & Pennsylvania Ave., N.W. (6).

● **WESTERN MICHIGAN:** 1931. Hdqrs., Grand Rapids, Mich. Meets, Second Monday. PRESIDENT, H. R. Limbacher, 760 E. Vine St., Kalamazoo. SECRETARY, F. K. Platt, P.O. Box 307, Kalamazoo.

● **WESTERN NEW YORK:** 1919. Hdqrs., Buffalo, N. Y. Meets, Second Monday. PRESIDENT, I. M. Quackenbush, 505 Franklin St. (2). SECRETARY, Q. P. Thompson, 360 Richmond Ave. (22).

● **WISCONSIN:** 1922. Hdqrs., Milwaukee, Wis. Meets, Third Monday. PRESIDENT, J. A. Lotte, 2505 N. 97th St., Wauwatosa (10). SECRETARY, I. J. Rossiter, 231 W. Wisconsin (3).

SPECIAL BRANCH

● **SWISS:** 1952. Hdqrs., Zurich, Switzerland. PRESIDENT: Leo de Bruyn, Muhlebachstr, 172, Zurich. SECRETARY: Walter Hausler, Erbstrasse 2, Kusnacht, Zurich.

STUDENT BRANCHES

● **NORTH CAROLINA STATE COLLEGE:** 1948. Hdqrs., Raleigh, N. C. PRESIDENT, Sydney Narvey, S-B Vetville, State College Station. SECRETARY, E. A. Travis, Jr., P.O. Box 3333, Bagwell Dormitory.

● **OKLAHOMA A. & M. COLLEGE:** 1950. Hdqrs., Stillwater, Okla. PRESIDENT, Stuart Cohen, 513½ Knoblock. SECRETARY, H. G. Rice, 5 Chickasha, Box 417, Vets Village.

● **OREGON STATE COLLEGE:** 1949. Hdqrs., Corvallis, Ore. Meets, First Wednesday after First Tuesday. PRESIDENT, D. W. Blair, 223 W. 15th St. SECRETARY, C. D. Cannon, 404 N. 26th St.

● **PURDUE UNIVERSITY:** 1948. Hdqrs., W. Lafayette, Ind. CHAIRMAN, N. J. Kirch, 922 Highland Ave., Lafayette. SECRETARY, H. F. Allen, Jr., 629 University St.

● **TEXAS A. & M. COLLEGE:** 1946. Hdqrs., College Station. Meets, Second and Fourth Tuesday. PRESIDENT, J. O. Kadel, Box 4054. SECRETARY, W. C. Haggard, Box 5227.

● **UNIVERSITY OF DETROIT:** 1949. Hdqrs., Detroit, Mich. Meets, First Tuesday. PRESIDENT, T. J. Feahney, Jr., 18263 Oak Dr. (21). SECRETARY, W. F. Thull, 18313 New Jersey (19).

● **UNIVERSITY OF KANSAS:** 1949. Hdqrs., Lawrence, Kans. Address mail to Dr. Warren E. Snyder, chairman, Dept. of Mechanical Engineering, University of Kansas.

● **UNIVERSITY OF TEXAS:** 1949. Hdqrs., Austin, Tex. Meets, First and Third Tuesday. PRESIDENT, W. A. Cox, 360-D Deep Eddy Apts. SECRETARY, V. H. Miles, PHP Dorm J.

● **UNIVERSITY OF TORONTO:** 1951. Hdqrs., Toronto, Ont. CHAIRMAN, J. A. Slemin, 21 Wilberton Rd. SECRETARY, T. O. Smith, 455 Avenue Rd.

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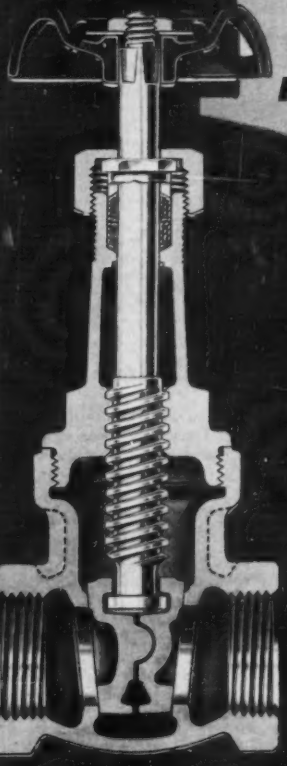

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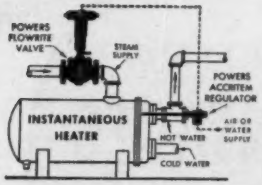

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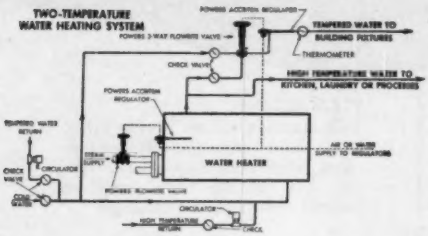

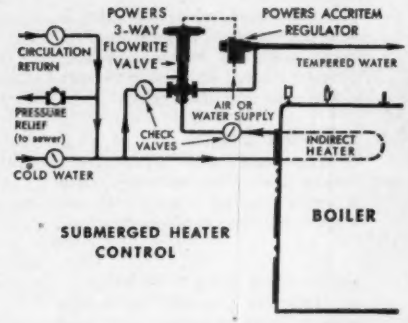

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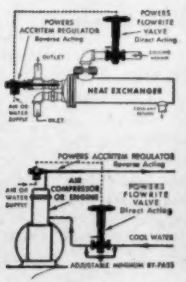

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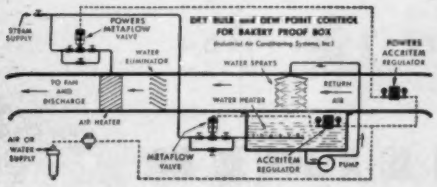

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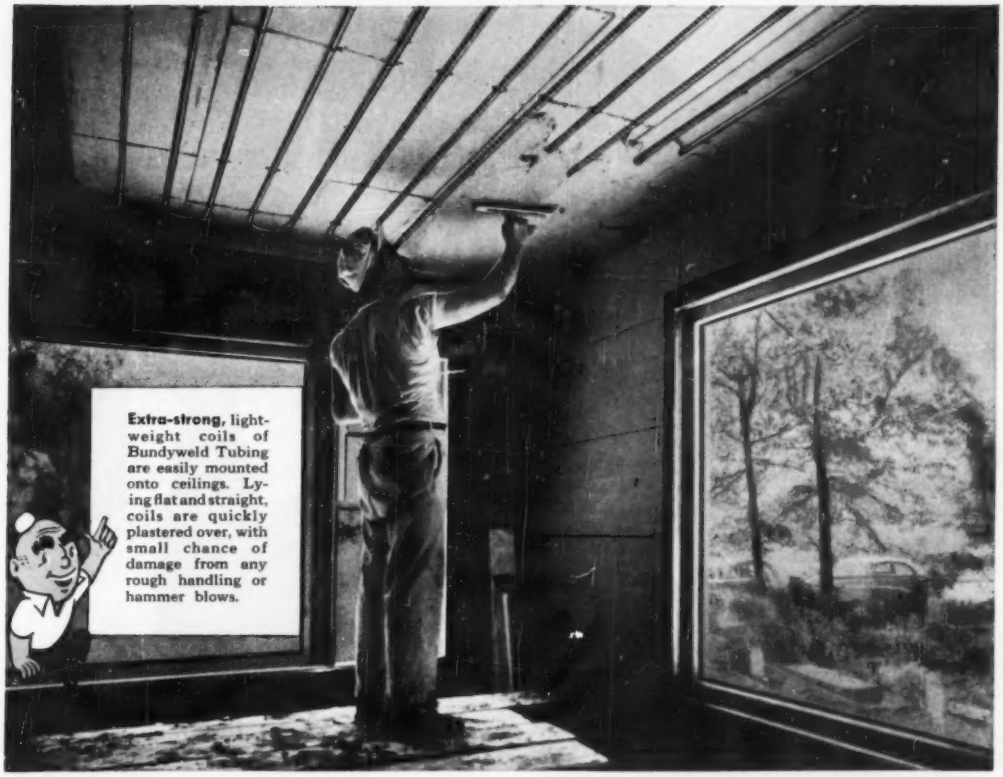
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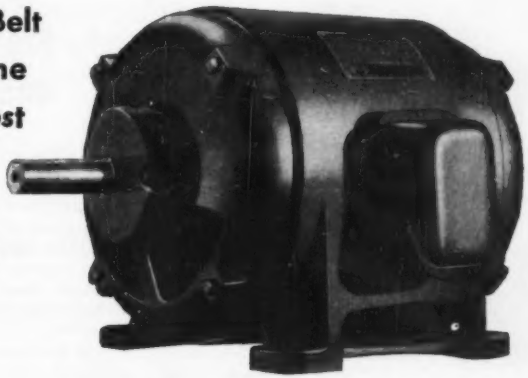

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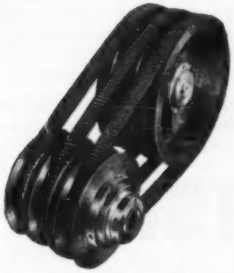

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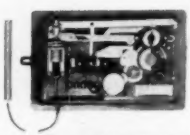
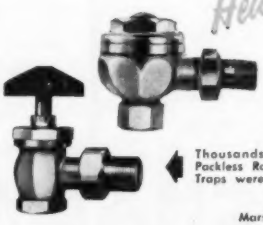
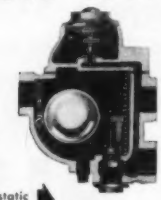


BIG SAVINGS *with*
MARSH *Tri-Trol regulation*

Maximum comfort at minimum cost when heat is controlled in accordance with outside regulation with Marsh Tri-Trol. Ask for facts.



Thousands of these Marsh Packless Radiator Valves and Traps were used.

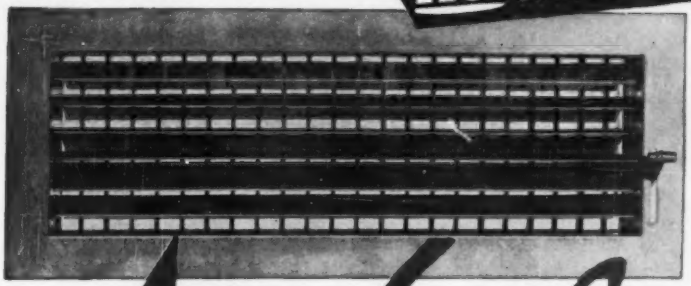


Marsh float and thermostatic traps were used throughout.

MAKES ANY AIR CONDITIONING SYSTEM A BETTER AIR CONDITIONING SYSTEM

Yet it COSTS LESS . . . . . .

● *Illustrated below—* #276 4-way multi-shutter register . . . features front louvers and rear damper blades parallel to long dimension . . . second row louvers parallel to short dimension.



Air Foil

4-WAY MULTI-SHUTTER REGISTER

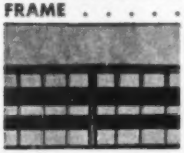
SOLID-SECTION AIRFOIL LOUVER

● Louver knifes air in wind tunnel tests. Turbulence has been almost eliminated giving noiseless control of air.

LEVER CONTROL

●Inconspicuous lever in face of frame controls dampers for complete shut-off.

EXTRA-STRENGTH FRAME . . . . .



● New, exclusive Titus concealed support eliminates unsightly mullions and butted construction.

The smartly designed #276 combines *4-way #270 grille* with the *multi-shutter damper* to assure maximum directional control with positive volume control and shut-off. Damper blades interlock for complete shut-off.

The two front sets of louvers are individually adjustable with blades on ¾ inch centers.

Dampers are controlled from face of grille by inconspicuous lever. Removable lever furnished at no extra cost.

EXTRA STRENGTH—LONGER LIFE

Sound, inspired know-how engineering gives the #276 superb simplicity of design with no unnecessary parts—no clumsy bulk. A special patented, *concealed support* eliminates unsightly mullions and butted construction permitting superior strength with no added weight.

EASY TO INSTALL

#276 grilles are light in weight—easy to carry—easy to fit—easy to put in place. *Save much costly time and labor.*

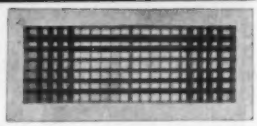
EXTRA VALUE AT LOWER COST

AIRFOIL grilles are priced down to give you more value—more performance—more efficiency—at less cost.

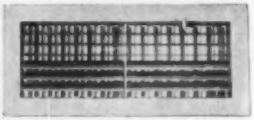
NOTE THESE OUTSTANDING AIRFOIL FEATURES . . .

- Smooth-as-glass AIRFOIL louvers.
- Extra-heavy frames.
- Airtight rubber gasket.
- Positive shut-off.
- Individual louver adjustment.
- Removable lever.

LOOK TO AIRFOIL FOR THE FINEST

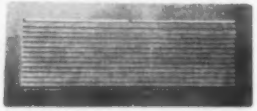


L-270 4-way directional grille for complete control of air stream.

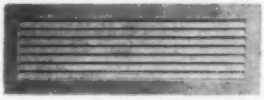


L-274 Double directional grille with multi-shutter damper.

S-8 4-way grille with louvers on ½" spaced front.



RL-21 Return air grille of fixed deflection type with closely spaced louvers.



RL-230 Return air grille incorporates rugged construction and smart design.

AG-25 Volume controller designed to fit behind grille.

CHECK TYPE OF GRILLE ON WHICH INFORMATION IS DESIRED

- ☐ Air conditioning outlets
- ☐ Perforated metal and ornamental grilles
- ☐ Return air grilles and registers
- ☐ Door ventilators
- ☐ Volume controllers
- ☐ Special made-to-order grilles

TITUS MANUFACTURING CORP., WATERLOO, IOWA

____Send complete catalog.
____Send literature on above checked items.

NAME _____

ADDRESS _____

CITY _____ STATE _____

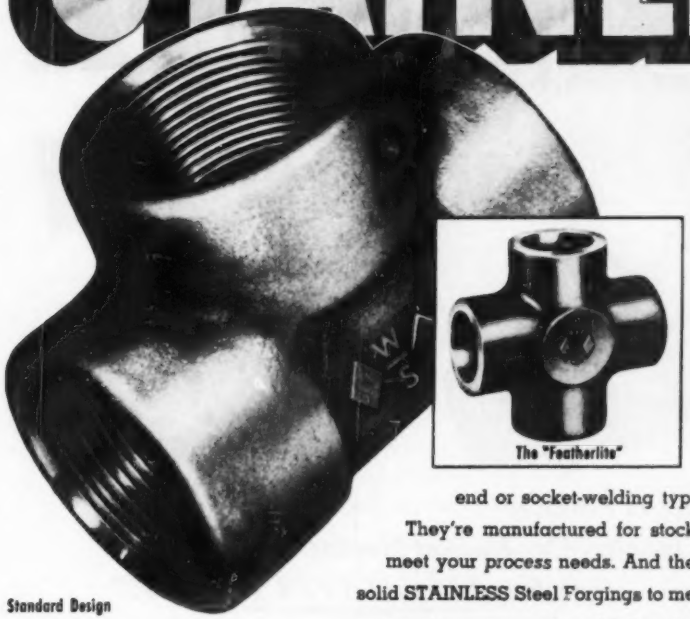
"Santa Claus
is coming to town"
— and to each of you, we sincerely hope he brings with him the perfect answer to your every wish. Good health, happiness and prosperity.
Season's Greetings from —
WHEATLAND TUBE COMPANY
Bankers Securities Building, Juniper and Walnut Sts., Phila. 7, Pa.
-pipe with the yearmark!

To meet your needs . . .

W-S FITTINGS OF FORGED

STAINLESS

STEEL



Standard Design

The "Featherlite"

Stainless systems are critical and costly...Protect them where trouble usually starts . . . with

W-S FORGED STAINLESS FITTINGS

These life-of-the-system joints are available in either screw-end or socket-welding types to meet your *assembly* needs. They're manufactured for stock in the more popular grades to meet your *process* needs. And they're all precision machined from solid STAINLESS Steel Forgings to meet a *universal* need for the strongest, most accurate and trouble-free fittings money can buy.

Get the full benefit of your investment . . . insist on W-S FORGED fittings wherever costly stainless pipe or tubing meet . . . *permanently*.

WRITE FOR BULLETIN S-1 for Standard Design 2,000 to 6,000 pound cold non-shock pressure

WRITE FOR BULLETIN S-2 for "Featherlite" Design 1,000 pound cold non-shock pressure

Screw-End and Socket-Weld Types

• **Tighter** • **Stronger** • **More Uniform** • **Lower Service Cost**

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

WATSON-STILLMAN FITTINGS DIVISION

H. K. PORTER COMPANY, INC.

ROSELLE, NEW JERSEY

M-69

Designers and Manufacturers of Forged Steel Fittings, Hand Pumps, Jacks, Wire Rope Shears and Pipe Benders

"Just Like Summer in February
Since We Installed Our Radiant Heating System
with READING COPPER TUBING!"

With requirements of copper tubing for defense needs leveling off, Reading Copper Tubing is now available in greater supply for radiant heating installations and other civilian purposes. Most sizes and types are now in stock for prompt delivery at your nearest Reading Distribution Depot. There's no need for substitution. For customer satisfaction and good will, recommend and supply Reading Copper Tubing—precision product of one of America's most modern, completely integrated mills processing from basic metal to finished tubing.

READING COPPER TUBING

READING TUBE CORPORATION

Producers of Reading Lektroneal Copper Tubing and Reading Brass Tubing

Stocks Available at ALL Reading Distribution Depots:

- **Reading, Pa.**
- **Houston, Texas: 1121 Rothwell St.**
- **Long Island City, N. Y.**
- **Chicago, Ill.: 724 W. 50th St.**

Offices and Eastern Distribution Depot:

36-12 47th Ave., Long Island City, N. Y.
Works: Reading, Pa. **STillwell 6-9200**

Before you buy an Expansion Joint

Read this!

Anyone in industry today recognizes those compelling factors which cause "purchase by price".

What is not so easy to see is that the "lowest price" is certainly no indication of the *value* of a product—no matter what it is!

That is why Zallea Expansion Joints—even though maintaining a competitive price position in their field—*guarantee performance* and *quality*. These characteristics are built into every Zallea Expansion Joint which has ever left our plant—and are measurable in dollars and cents by any industrial buyer.

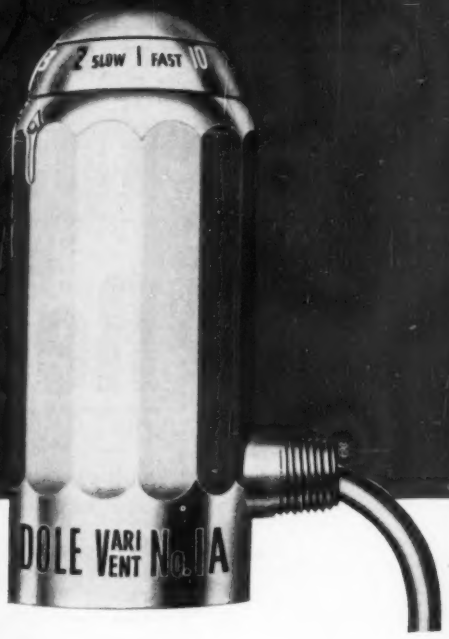
You will find—as have thousands of others—that the value of a Zallea Expansion Joint is in direct proportion to its service life. The proof? *Repeat orders* from customers *by the hundreds* in the last quarter of a century.

Before *you* buy an expansion joint, check *first* with a Zallea Representative for *proof* that your best buy is Zallea. There's no obligation, of course. Zallea Brothers, 816 Locust Street, Wilmington 99, Delaware.

Catalog 47 and Bulletin 351 describe the complete line of Zallea Expansion Joints and Flexible Connectors. Write for copies today.

Zallea
EXPANSION JOINTS

Instant Venting

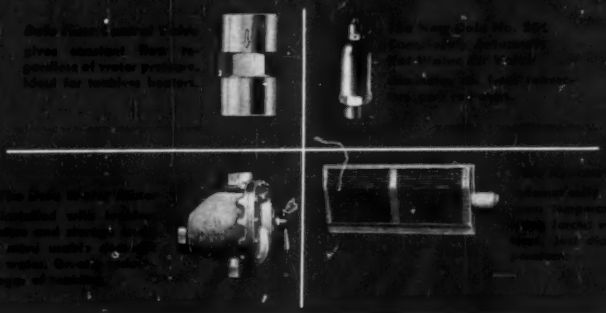


with DOLE 1-A VARI-VENT VALVES

The Dole Adjustable Vari-Vent Air Valve offers the instant venting so necessary with the one-pipe steam heating system. These valves are designed for use with oil, gas or stoker-fired heat. They can be quickly and easily adjusted for the desired venting speed.

1A Valves are easily adjusted for an equal distribution of steam to all radiators simultaneously. Both comfort and economy can be had with mere ounces of steam. Write for complete details.

the great DOLE line



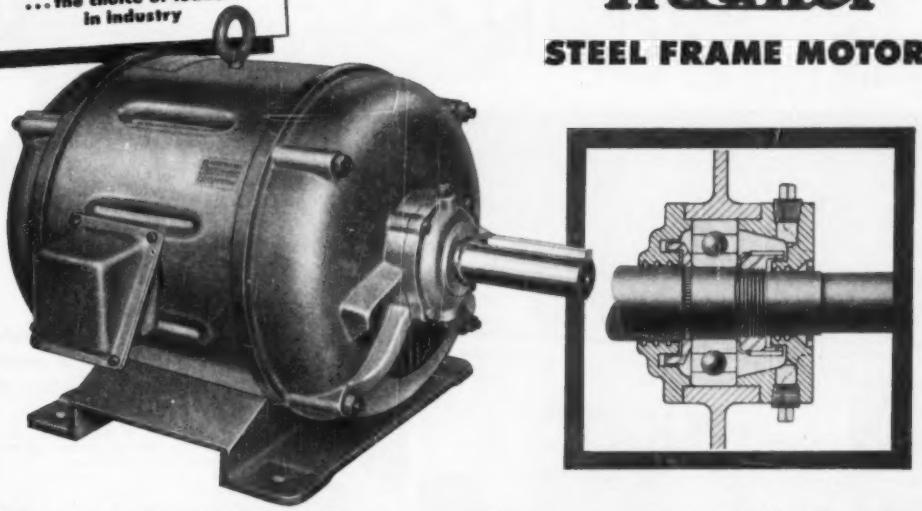
Control with Dole

DOLE

THE DOLE VALVE COMPANY
1933 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities

Wagner
ELECTRIC MOTORS
...the choice of leaders in industry

Wagner
STEEL FRAME MOTORS



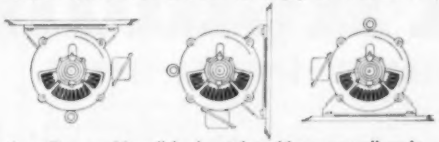
This sealed-bearing motor can be lubricated

Wagner Steel-Frame general purpose polyphase motors are equipped with labyrinth sealed bearing housings that effectively prevent the entrance of any dirt or grit that might cause premature wear. It is not necessary to lubricate the bearings—motors in the smaller frame sizes operate for years without relubrication. But... these Wagner Motors are provided with two lubrication openings — you *can* lubricate your motors when necessary or desirable, to add years of useful motor life in unusually severe applications.

Wagner's Bulletin MU-131 gives valuable information concerning proper lubrication of electric motors — Copies will be sent you on request.

DRIP-PROOF...3 WAYS

These open-type motors (in frames 326 and smaller) are completely drip-proof in any horizontal position because there are no openings in the frame and the end-plates can be rotated 90° or 180° for drip-proof installation



in ceiling or sidewall horizontal positions, as well as in the normal horizontal position.

Wagner Steel-Frame Motors are available in electrical types to meet most industrial requirements. Bulletin MU-185 gives full information—write for your copy.

WAGNER ELECTRIC CORPORATION
6370 Plymouth Ave., St. Louis 14, Mo., U.S.A.

®Wagner Electric Corporation EST. 1891

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

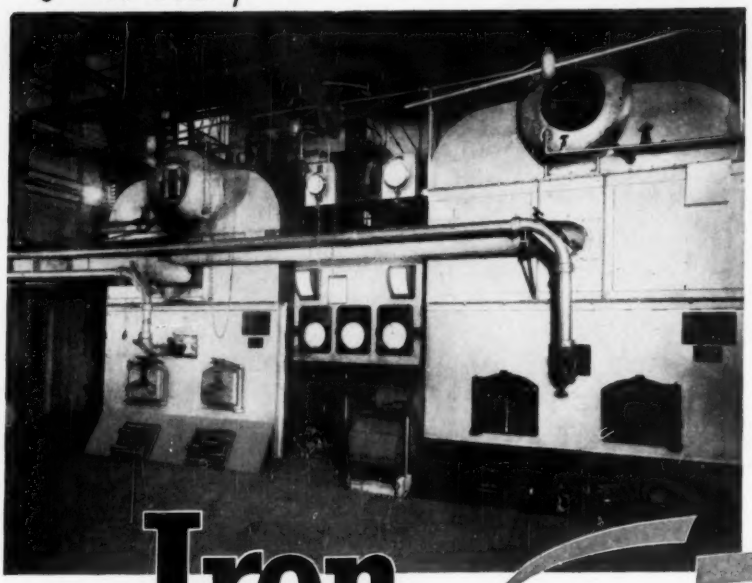
BRANCHES IN 32 PRINCIPAL CITIES

M52-17

"Our Iron Fireman stokers burn lowest grade coal yet deliver top efficiency"

Says Mr. Wm. F. DeWolfe, Chief Engineer, St. Joseph's Hospital, Saint John, N. B.

"Our steam demand varies from 50% to 150% of boiler rating and we are very well pleased with the flexibility and over-all performance of our Iron Fireman stokers. We are burning Minto coal, the lowest grade coal in this area, yet the monthly average efficiency has been as high as 81% at an average monthly rating of 82% of capacity. At summer loads with boiler rating down to 30% and lower we can still get 65% efficiency."



Iron Fireman Pneumatic Spreader stokers in the St. Joseph's Hospital boiler room. Coal is dried, pre-heated pneumatically conveyed and distributed over the entire fuel bed.

Iron Fireman

PNEUMATIC SPREADER STOKERS

The Iron Fireman Pneumatic Spreader stoker is a coal-drying, coal conveying, and highly efficient combustion system, all in one money-saving package. It burns a wide range of coals, including low-ash fusion, sub-bituminous and lignite—ranging from ¾" slack to 2" top size. The fuel is dried and conveyed by hot furnace gases directly from main bunker to fire. Readily adaptable to any boiler room layout. Capacities available to 1,000 boiler horsepower in single units; multiple units for larger capacities. Find out how much an Iron Fireman can save for YOU. Phone your nearest dealer or send coupon for descriptive literature.

MAIL COUPON FOR LITERATURE

IRON FIREMAN MANUFACTURING CO.
3276 West 106th Street, Cleveland 11, Ohio.

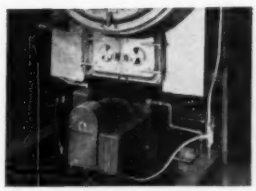
Please send literature as checked:

☐ Pneumatic Spreader Stoker ☐ Coal-Flow Stoker
☐ Commercial Gas Burner ☐ Rotary Oil Burner

Name_____

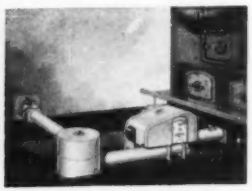
Address_____

City_____ State_____



Iron Fireman Rotary Oil Burner

Fires low-cost, heat-rich heavy oils (5 & 6) with complete uniformity regardless of viscosity. A real money-saver. Capacities to 500 boiler horsepower.



Iron Fireman Coal-Flow Stoker

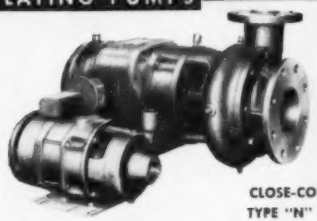
Feeds coal direct from bin. No coal handling. Coal and air automatically adjusted to boiler load at all times. Capacities to 500 boiler horsepower.

AUTOMATIC FIRING FOR HOMES, BUILDINGS, INDUSTRIAL PLANTS

THERE IS A *Chicago* PUMP FOR EVERY BUILDING SERVICE

For circulating service, heating, bilge or sewage pumping, Chicago equipment is the best available. Each pump is specifically designed for the job. Over 40 years experience with pumps for every application is built into every unit. That is why construction leaders everywhere specify Chicago pumps.

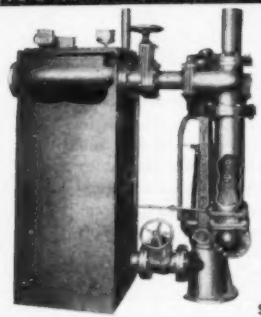
CIRCULATING PUMPS



CLOSE-COUPLED TYPE "N" PUMP

Compact, sturdy unit with bronze impeller keyed to stainless steel motor shaft. Precision built mechanical seal on shaft requires no adjustment, eliminates dripping. For capacities up to 500 GPM and heads up to 215'. Also available with standard horizontal motors and flexible coupling drive. Screwed pipe connections on pump up to 2". 3" pump has flanged connections. Write for Bulletin 108. For greater heads and capacities see Bulletin 101 for Double Suction Horizontally Split Case Centrifugal Pumps, and Bulletin 103 for Multi-Stage Centrifugal Pumps.

SEWAGE AND BILGE PUMPS



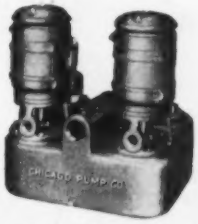
"FLUSH-KLEEN" SEWAGE EJECTOR

The only positively clog-proof sewage ejector. Impellers handle nothing but strained sewage, minimizing wear and maintaining pump balance. All coarse material is retained on Flush-Kleen screen and automatically flushed to the sewer on each pumping cycle. Flush-Kleens are furnished as a complete package as illustrated, and for either submerged or dry well installations to meet all sewage pumping conditions. For complete information write for Bulletin 122. A complete line of Vertical Closed Shaft Non-Clog Bilge Pumps is illustrated and described in Bulletin 124.

HEATING PUMPS

"CONDO-VAC" VACUUM AND BOILER FEED PUMP

The Duplex "Condo-Vac" with Duplex Automatic Control. Available in single units. Specifically designed for vacuum heating systems, "Condo-Vac" Pumps are used as return line condensation, vacuum and boiler feed pumps. Water capacity remains constant up to boiling point. Air capacity remains constant to evaporation point. Pressure up to 40 lbs. Capacities from 2500 to 150,000 EDR. For complete data ask for Bulletin 270.



"AVC" DUPLEX CONDENSATION PUMP AND RECEIVER

Heavy cast iron receiver with low inlet for floor mounting or shallow pit. Sets on floor—no foundation necessary. Occupies small space. Weight of unit and piping hold it firmly in place. Also available in single model. For service from 500 to 10,000 EDR and from 10 to 30 lbs. pressure. Write for Bulletin 245. The Sure Return Condensation Pump and Receiver; available in single and duplex models for systems up to 25,000 EDR and up to 80 lbs. pressure, is described in Bulletin 250. For underground installation specify Type CLLI. For 1000 to 40,000 EDR and 10 to 25 lbs. pressure. Write for Bulletin 253.

All ratings and receiver capacities meet or exceed ASHVE standards.

CHICAGO INDUSTRIAL PUMPS

CHICAGO PUMP COMPANY

BUILDING and INDUSTRIAL DIVISION

622 DIVERSEY PARKWAY

Condo-Vac, Sure Return, AVC, LVC, Fire, House & Circulating Pumps Pneumatic & Tankless Water Systems.

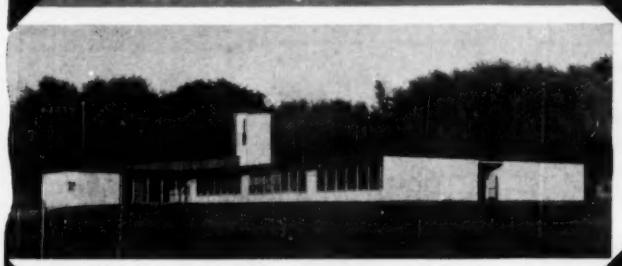
CHICAGO 14, ILLINOIS

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use.

PAGE 10

1952 TEMPERATURE CONTROL ALBUM

the place



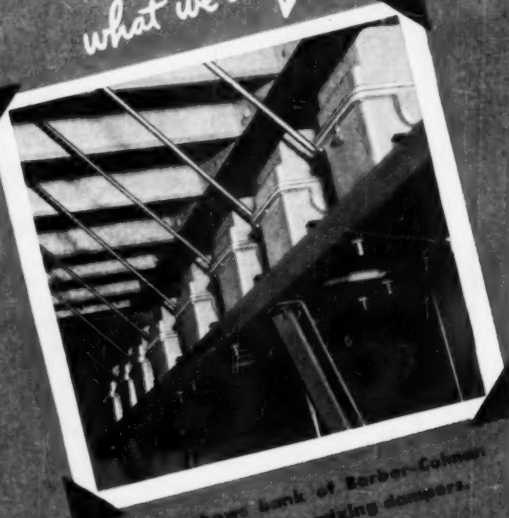
Oakland Elementary School
Bloomington, Illinois

who was there

Architects:
Lundeen and Hillinger
Bloomington, Illinois

Heating Contractor:
American Foundry and
Furnace Company
Bloomington, Illinois

what we did



Above photograph shows bank of Barber-Colman Control Motors which operate mixing dampers.

notes of interest

Our purpose in this new school was to provide a simple, low-cost, warm air panel heating and ventilating system. In this installation, the temperature in each room is individually controlled, and is kept constant by a Room Microtherm* and a proportioning type Control Motor on the mixing dampers in each room duct system. Air is distributed quietly and without drafts after passing through panel heating ducts in the floor. In each classroom, Barber-Colman UNI-FLO Air Distribution Outlets are set in the window ledges.

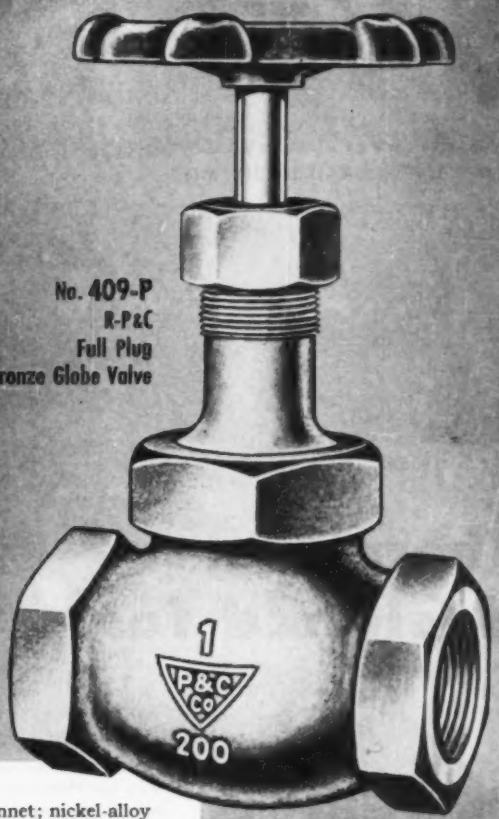
*Reg. U.S. Pat. Off.

BARBER-COLMAN COMPANY
1228 ROCK STREET • ROCKFORD, ILLINOIS

BARBER COLMAN

For the complete story on Barber-Colman Controls, write for Catalog F-2207-3.

an ACCO product



No. 409-P
R-P&C
Full Plug
Bronze Globe Valve

• High test bronze body and bonnet; nickel-alloy disc and seat ring; high tensile, high torque rolled bronze stem—plus large, deep stuffing box easily repacked under pressure—these are the features which make R-P&C Bronze semi-plug and full-plug Globe and Angle Valves outwear ordinary valves. They're fine for frequent or continuous throttling of steam, gas, oil, water. This type valve can be furnished in 200, 300 and 350 lb. pressures.

See your R-P&C distributor for information on the complete line of R-P&C valves or write nearest district office.

R-P&C valves

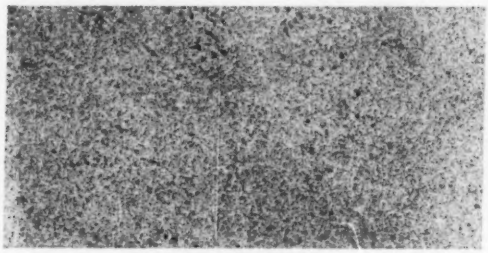
ACCO
TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

ENTRAINED GREASE AND LIQUID MIST

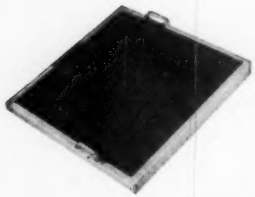
SMOKE AND FUMES



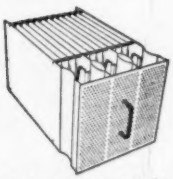
NUISANCE DUST

EXTREMELY FINE DUST

There's an Air-Maze filter designed for every need



Viscous impingement air filter panels available in all-metal or disposable types.



Electromaze electronic air filter with "file drawer" design.

NO *ONE* AIR FILTER can be designed as the cure-all for *all* ventilating problems. That's why Air-Maze has designed many types and sizes of air filters—not just one or two. That's why Air-Maze engineers want the answers to questions like these before recommending the best filter for your particular needs:

What's the size and character of the airborne particles to be filtered?
Is the dust concentration light, heavy or average?
What's the air velocity?
What filtering efficiency is required?
How often is servicing practical?
How much room do you have for the filter installation?

Knowing the answers to these questions, Air-Maze engineers can specify the type and size of Air-Maze filter that *best suits* your combination of conditions. They don't make your problem fit the filter—they've designed the filter to fit your problem.

To get the expert help you need in solving your air filtering problems, call your nearby Air-Maze representative or write Air-Maze Corporation, Cleveland 5, Ohio.

AIR FILTERS
SILENCERS
SPARK ARRESTERS

AIR-MAZE
THE FILTER ENGINEERS

LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

The U. S. Steel Supply team that gives you

personalized service

Our *telephone salesman* is your "on-the-spot" assistant!

OUR telephone salesmen are trained to look at your business from *your* viewpoint. They are your "on-the-spot" assistants in our organization. When you want steel or supplies or need information quickly about availabilities, priorities or prices, pick up your phone and call one of our salesmen. He can turn your inquiry into immediate action and follow it through, if necessary, until you receive the steel or information you want.

Most of our customers call their telephone salesman, because it suits their convenience to place their orders or inquiries by phone. It gets their steel buying done fast! Whatever your reason for contacting one of our telephone salesmen, you'll find that your business is handled promptly, intelligently, courteously and with the personal interest that marks every member of the U. S. Steel Supply team.

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UNITED STATES STEEL

COMING...

THE ANNUAL DIRECTORY and SHOW NUMBER of HEATING, PIPING & AIR CONDITIONING JANUARY—1953

Subscribers . . . .

Here's your 1953 Buying Guide—completely up to date in its lists of manufacturers of every kind of product for industrial and large commercial, institutional and public building heating, piping and air conditioning services. It'll give their street addresses, trade names.

Your January issue will serve you throughout the important year ahead whenever you're looking for information on who makes a product, where he's located, whose products various trade names represent.

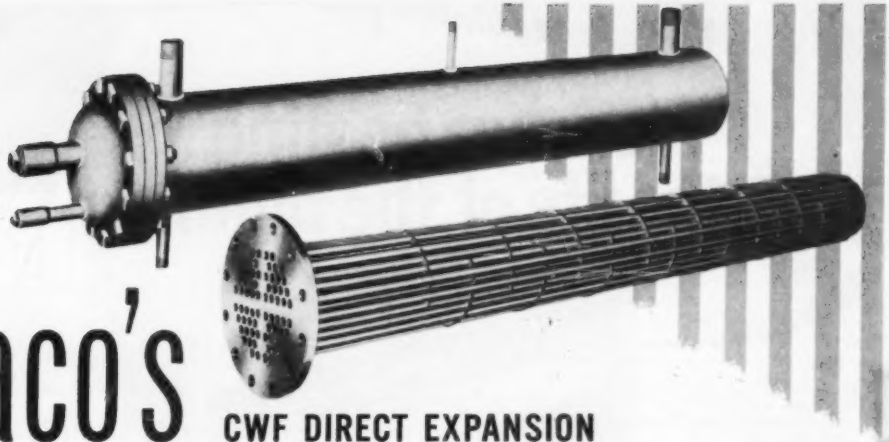
In addition, many manufacturers, in their advertising copy, will give you complete data on their lines, product specifications, applications, etc.

Months of work have gone into checking manufacturers' equipment literature, correcting addresses, adding new names in the field. . .all to give you the most complete and accurate product reference book possible.

Be sure your subscription is renewed, if it is expiring soon, so you won't miss your copy of our important January Directory and Show Number.

ANOTHER FEATURE OF THIS ISSUE WILL BE A SPECIAL SECTION ON THE 11TH HEATING & VENTILATING EXPOSITION IN CHICAGO IN JANUARY — what's going on, what will be displayed.

LOOK FOR YOUR COPY OF THE JANUARY 1953 ANNUAL DIRECTORY AND SHOW NUMBER OF HEATING, PIPING & AIR CONDITIONING



Taco's CWF DIRECT EXPANSION Evaporators (FOR LIQUID CHILLING OR WATER COOLING) Mean Greater Profits

FOR AIR CONDITIONING AND REFRIGERATION CONTRACTORS

Quality Construction and Better Design Give Long Life, Maintenance-Free, Low Cost Operation

TACO HEATERS, Incorporated, since 1920, has backed heating and air conditioning contractors with the highest quality heat exchangers, such as those illustrated in this ad: water heaters and coolers, fuel oil heaters, condensers, instantaneous water heaters, converters and tank heating units.

Now, Taco has increased its production facilities to match the air conditioning and refrigeration industry's growth. Taco's "know how" in large heat exchanger design and installation is at the service of all its friends in the industry.

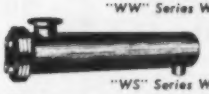
Better Heating-Better with Taco

Taco

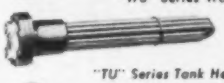
TACO HEATERS, INCORPORATED • 137 SOUTH STREET, PROVIDENCE 3, R. I.

TACO MAKES A WIDE LINE OF SHELL & TUBE HEAT EXCHANGERS
4 of which are shown below

"WW" Series Water Heaters



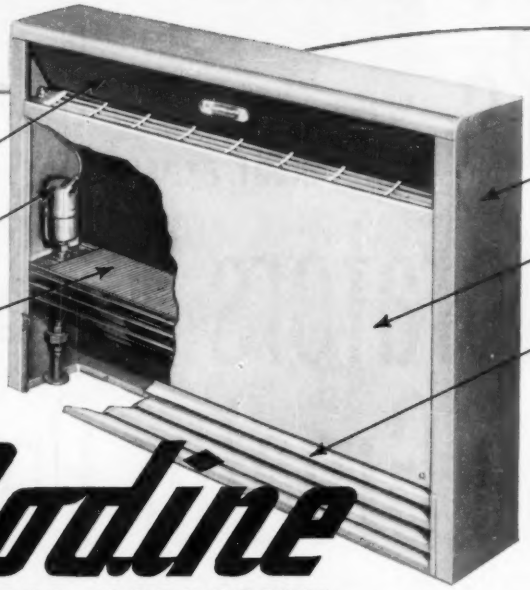
"WS" Series Water Heaters



"TU" Series Tank Heating Units

Straight Tube Heat Exchangers

Plan your heating for the life of the building



Unique damper, for finger-tip temperature control, conceals curved outlet air grille.

Air vent can be conveniently located at either end of outlet grille—instantly accessible.

All steam-carrying passages are copper or copper alloy . . . brazed for pressure-resisting strength.

Steel enclosure is Bonderized for rust protection, built to "take it."

Front panel is quickly removed and replaced by means of two screws for full access to unit.

Attractive lower grille (optional) snaps in or out, conceals piping.

Popular Type F illustrated. For exposed or recessed installation. Immediately available from most jobbers' stocks.

Modine

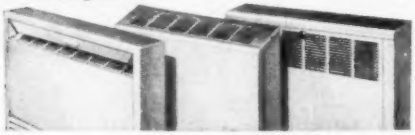
CONVECTOR RADIATION

offers the best in long-life, economical service

Simplicity of styling complements the beauty of both modern and traditional design, also promotes ease of cleaning.

DON'T sacrifice quality on built-in permanent heating equipment. To get the finest in modern, long-life heating . . . at lower over-all costs—follow the lead of top architects and heating engineers. Choose Modine Convector Radiation. It's your assurance of many years of heating system satisfaction. For complete information, see the Modine representative listed in your classified phone book. Or for your copy of Bulletin 251, write Modine Mfg. Co., 1509 DeKoven Avenue, Racine, Wisconsin

Choose from three enclosure types in standard and heavy-duty institutional models for free-standing, recessed or wall-hung installation.



New Resistance Thermometers Accurately Indicate and Control Low Temperatures

TEMPERATURES FROM −100 F to +300 F can now be accurately indicated and controlled with General Electric's new line of resistance thermometers. They indicate accurately within ½ of 1 per cent full scale. Any change in temperature equivalent to 1/10 of 1 per cent full scale starts immediate control action.

Normal changes in humidity or room temperature do not affect the exactness of control. Neither does a change in control voltage. Sturdy, simple construction assures reliable operation under severe operating conditions.

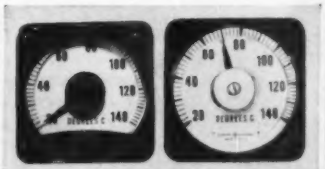
NARROW TEMPERATURE SPANS, as small as 90 degrees, are available anywhere in the −100 F to +300 F range. You can buy four types of resistance thermometers—indicators, protectors and two- or three-position controllers—for either flush or surface mounting.

For complete information, mail the coupon below.

G-E Thermocouple Potentiometer Accurate Within 0.2% Full Scale

This thermocouple potentiometer measures temperature in locations inaccessible to glass-stem thermometers. Readings can be taken in rapid succession and are accurate to within ±0.2% of full scale.

Typical applications include refrigerator-development work, oil-burner and air-conditioning tests, steam temperature measurements, and heat-run tests on electric equipment.



New Shadow-proof Temperature Indicators Are Easier to Read

Temperatures from −100 F to +300 F can now be accurately indicated with General Electric's new line of resistance temperature indicators. These instruments can be read from almost any angle. The dial is set forward, flush with the front of the case. A protruding convex-type glass front provides clear illumination. No more cover overhang; no more shadows caused by overhead lighting. Two sizes available—4¾ and 8¼ inches. Check coupon.

Easy to Use G-E Hand Pyrometer Available With Two Scale Ranges

Simply flick a switch to change scale ranges on General Electric's new Type FH-1 hand pyrometer. This unique feature in the new FH-1 cuts testing time, eliminates use of several pyrometers.

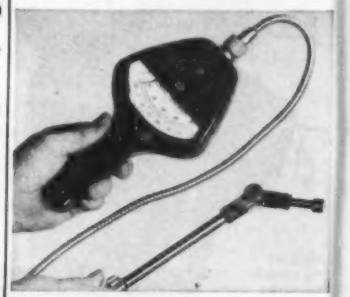
The Type FH-1 hand pyrometer is designed for rapid and convenient measurement of surface, liquid gas and molten-metal temperatures.

THREE INTERCHANGEABLE TIPS

A surface tip, an immersion tip for liquids and molten metals, and a 2-prong contact are supplied with the FH-1. In addition, a carrying case and flexible and rigid arms are provided for the FH-1. Both tips and extension arms are interchangeable in seconds.

AUTOMATICALLY COMPENSATED

Readings can be made directly for either scale of the instrument. With automatic cold-end compensation the FH-1 needs



no manual adjustment for variations in temperature in either the instrument or surrounding atmosphere.

See your nearest G-E representative today for complete information on the FH-1, or check coupon for GEC-836. Price of equipment shown in photo is $118.17*

*Manufacturer's Suggested Retail Price

SECTION D602-242, GENERAL ELECTRIC
SCHENECTADY 5, N. Y.

Please send me the following bulletins:
Indicate:

√ for reference only
× for planning an immediate project

☐ Resistance Thermometer (GEC-835)
☐ Thermocouple Potentiometer (GEC-245)
☐ Temperature Indicators (GEC-565)
☐ Hand Pyrometer (GEC-836)

NAME .....

COMPANY .....

STREET .....

CITY ..... ZONE ..... STATE .....

GENERAL ELECTRIC

INDUSTRY'S ALL-TIME FAVORITE FOR LONG RANGE

Economy

JENKINS
Fig. 106-A
Renewable Composition Disc

BRONZE GLOBE VALVE

150 lbs. Steam
200 lbs. O.W.G.

Take a Jenkins Fig. 106-A apart. It's easy to see why it is industry's all-time favorite. Note the liberal dimensions of body and bonnet casting — the heavy, manganese bronze spindle, with more strong threads in contact with the bonnet, regardless of spindle position. See how the slip-on, stay-on disc holder fully protects the edge of the disc, prevents creeping, flaking, or cracking.

Every part, from perfect grip, heatproof handwheel to pipe ends, reflects the designing skill of Jenkins valve *specialists.* There's a good reason. Jenkins Bros. introduced the *first* renewable composition disc valve, — is today the only manufacturer of both valves *and* discs.

Fig. 106-A not only looks better — it proves out better in performance. In any comparison, its long life, low upkeep record has never been surpassed. That is the true measure of valve cost — and it is the reason why industry's shrewdest buyers will settle for nothing less than Fig. 106-A quality.

JENKINS VALVES

LOOK FOR THE DIAMOND MARK

SINCE 1864 TRADE JENKINS MARK

Jenkins Bros.

GET THIS FOLDER — Gives details of Fig. 106-A design, and "family" interchangeability. Ask your Jenkins Distributor for Form 189-A, or write Jenkins Bros., 100 Park Ave., New York 17.

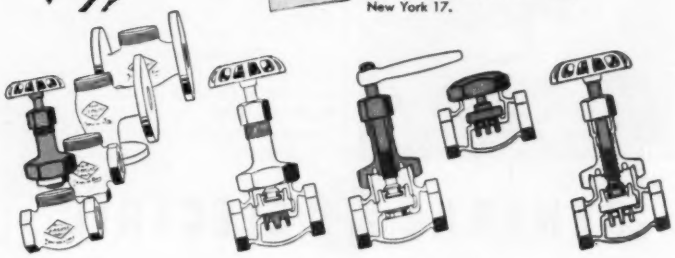
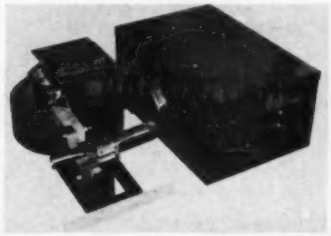


Fig. 106-A "Family" interchangeability meets 90% of your valve needs with a small inventory of parts. Start with the standard Fig. 106-A. Trimming is interchangeable in Globe or Angle body, screwed or flanged. With a few parts, quickly-assembled combinations provide a Lift Check, a Spring-loaded Check, and valves for Stop and Check, Quick-opening, or Throttling service.

EQUIPMENT DEVELOPMENTS...

Electromagnetic Pump

HPAC 1* — A-c electromagnetic pump for pumping liquid metals and other low resistance conducting fluids at temperatures up to 1000 F. . . . The pump, which has no moving parts, is designed to move any conducting fluid that has a specific resistance equal to or less than stainless steel. The fluid serves as the conductor so that



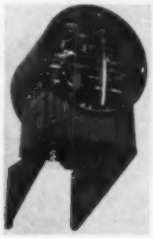
when current and flux are applied, pumping occurs. The three basic elements are a transformer unit, a cell unit and a capacitor unit. The amount of liquid metal which can be pumped in a given period varies with the pressure. It operates on 230 volts at 30 amperes. [Manufacturer: General Electric Co., Schenectady 5.]

Expansion Joint

HPAC 2 — Packless expansion joints for hot water lines. . . . Factory-assembled unit is made to absorb expansion of baseboard radiation, finned convectors, horizontal supply lines, etc. A two-ply seamless bellows absorbs pipe line expansion and provides a seal against leakage. The expansion joint is made for pipe sizes ¼, 1, 1¼ and 2 in. and absorbs line expansion up to ½ in. Maximum working pressure is 40 psig and maximum test pressure, 60 psig. [Manufacturer: Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Box 400, Knoxville 4, Tenn.]

Electric Unit Heater

HPAC 3 — New, large, 20 kw "Chromalox" blower-type unit heater. . . . Suitable for floor, wall or ceiling mounting, it has adjustable louvers which can be tilted to deflect the warm air stream up and down about 20 degrees. [Manufacturer: Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh 8.]



Heater

Return Unit

Condensate Return Unit

HPAC 4 — "Apco-Matic" return unit suitable for handling condensate for heating systems with ratings from 800 to 10,000 EDR and pressures up to 60 psi. . . . Units are designed with latest features of turbine-type pump design with minimum space requirements. Close coupling is used to give quiet operation. Dual discharge openings provide optional connection for piping to boiler. A mechanical seal prevents leakage. [Manufacturer: Aurora Pump Co., 80 Loucks St., Aurora, Ill.]

Heating System Uses Small Tubing

HPAC 5** — Individual room heater units filter and heat air according to thermostat controlled temperature. . . . Heating system operates from an insulated steam boiler with copper tubing for steam and condensate return

For your convenience in obtaining more information about any of this equipment, use this coupon. Add the new products and companies listed here to your Directory Section which you received in your January 1952 Heating, Piping & Air Conditioning, and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed.

FOR YOUR CONVENIENCE [12-52]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about equipment mentioned under these reference numbers in Equipment Developments.

(Circle each HPAC number in which you are interested)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25	26	27	28	29	

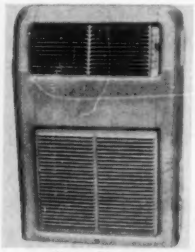
Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

from the boiler to each room unit. Unit draws in cool room air, filters it, heats it with steam and blows it into room with steam operated turbine blower. No electricity is used. [Manufacturer: Swenson Thermal Research, Inc., 2100 E. 65th St., Cleveland.]



Room Heater

Indicator

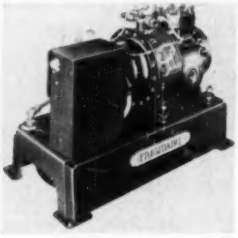
Photoelectric Smoke Indicator

HPAC 6 — "Fireye Photoelectric Smoke Indicator Series FE" indicates the density of smoke passing through the stack of a power plant and signals when the smoke density exceeds a certain value. . . . Indicators consist of three basic units: a light source, a photoelectric scanner and a control and indicator combined in a single housing. As smoke in the breeching passes through the light beam, the indicator shows a smoke density reading in indicator scale in both Ringelmann numbers and percent of smoke density. Red and green jewel lights provide visual indications. Alarm can be set to operate at any predetermined value of smoke density from 10 to 100 percent light cut-off. [Manufacturer: Combustion Control Corp., 720 Beacon St., Boston 15.]

Universal Vent Valve

HPAC 7 — Valve automatically vents air from steam systems and hot and cold water systems. . . . No. 500 valve may be cleaned without removing the valve or shutting down the heating system. [Manufacturer: Hoffman Specialty Mfg. Corp., 1001 York St., Indianapolis 7.]

Valve



Compressor

Reciprocating Compressors

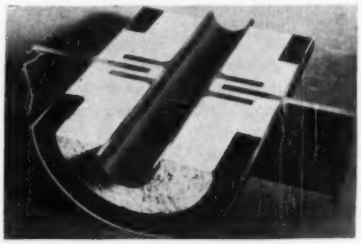
HPAC 8 — Sealed reciprocating compressors "XD Meter-Misers", ranging from 1/3 up to 7½ hp. . . . The light-weight compressors are either air-cooled, water-cooled, combination or those with evaporative condensers. All have direct-drive operation between motor and compressor, housed in the same casting and the motor-compressor unit is sealed against dirt and moisture and has no pulleys, belts or flywheels. A load selector is built into precision-made pistons. Lubrication is accomplished by means of a plunger-type lubricating pump. The oil supply is permanent. [Manufacturer: Frigidaire Div., General Motors Corp., Dayton 1.]

Solenoid Valve with Adjustable Timing

HPAC 9** — Solenoid valve, available for pressures up to 3,000 psi, has adjustable timing on the closing stroke for pressures up to 300 psi. . . . According to the manufacturer, this feature eliminates shock on supply lines, particularly on hydraulic operations. The valves are packless and are designed to handle hydraulic operations, oil, water, steam, air, gases and any media not harmful to bronze. [Manufacturer: Atkomatic Valve Co., 545 W. Abbott St., Indianapolis.]

Insulated Anchor for Underground Piping

HPAC 10 — Insulated anchor for use in underground insulated pipe systems conveying hot or cold liquids or gases. . . . The anchor is constructed so that contact is eliminated between anchor plate and pipe. The plate is insulated from the pipeline both thermally and electrically by a non-compressive block of Transite sheet material. The design and material serve to minimize heat loss at anchorage points and prevent pipeline corrosion due to electrolytic action. [Manufacturer: Durant Insulated Pipe Co., Watten Way and Bay Rd., Palo Alto, Calif.]



Reamer for Pipe

HPAC 11 — "Ridgid Spiral 2-S Reamer" cuts inside burr from pipe and conduit with minimum pressure. . . . New tool cuts holes in sheet metal also. Reamer capacity is ⅛ in. to 2 in. [Manufacturer: Ridge Tool Co., Clark St., Elyria, Ohio.]

Variable Speed Drive

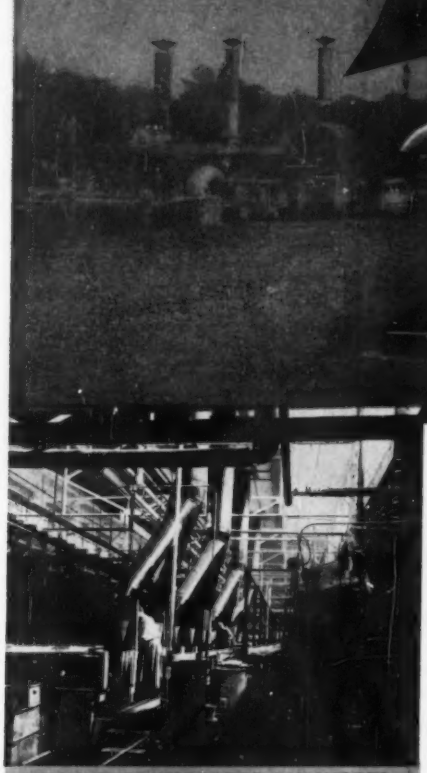
HPAC 12 — Variable speed drive comprising a variable pitch motor sheave, a set of wide range belts, a companion sheave, and a slide motor base. The company's "Taper-Lock" principle is used in the bushings for both sheaves. The pitch diameter is changed by means of one-point adjustments, and the variable sheave assembly locks on the motor shaft as a unit with the turn of a screw. [Manufacturer: Dodge Manufacturing Corp., 500 S. Union St., Mishawaka, Ind.]

Underwater Pump

HPAC 13 — Pump for use when water levels are 75 ft down or more with tank and automatic controls at the

ANOTHER PLANT SAYS . . . GOODBYE TO

FUME PROBLEMS



ABOVE: Four Bifurcator Roof Ventilators installed at Winters & Crampton Corporation, Grandville, Michigan. LEFT: Inside the plant, showing plating-tanks and exhaust duct work leading to roof ventilators.

PROBLEM: To select the best way of exhausting corrosive fumes from tanks where refrigerator and stove hardware is plated.

SOLUTION: Four Bifurcator Roof Ventilators installed on roof with exhaust duct work leading to them from plating tanks.

REASONS: "It was our choice to use this particular type of exhauster because of its simplified installation when compared to conventional centrifugal exhausters, which made it possible to omit elbows, sleeve band connections, discharge piping, and separate motor mounting and cover, which makes for a trim appearance. Ease of maintenance was also a consideration, as removal of weather top gives complete access to fan blade."

— Norman Davis, Plant Engineer
Winters & Crampton Corp.

RESULTS: "These four Bifurcator Roof Ventilators are doing a very satisfactory job of fume removal . . . performance is equal to, or in excess of, rated capacities."

— Norman Davis

HOW THE BIFURCATOR FAN WORKS

The DeBothezat Bifurcator is a direct motor-driven fan with a divided housing. Corrosive fumes are by-passed around the motor, which is mounted in a separate chamber, open to atmosphere but isolated from exhaust fumes. Bifurcator Roof Ventilators are equipped with weatherproof head and mounting base.

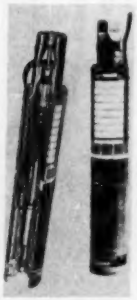
BIFURCATOR
ROOF VENTILATORS

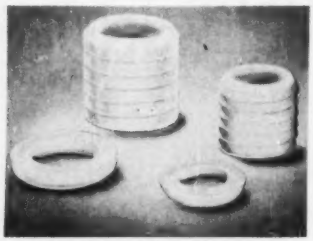
FREE BULLETIN
"Design Data for Lateral Tank Ventilation." 32-page bulletin describes standard 2-sided tank exhaust, rear manifold exhaust and jet "push-pull" systems. Ask DeBothezat Fans representative for a copy or write our factory, Dept. HP-12-52.

DE BOTHEZAT FANS DIVISION

American Machine and Metals, Inc., East Moline, Illinois

surface. . . . "The Diver" is available in ¾ hp and 1⅛ hp sizes. [Manufacturer: Uniflow Mfg. Co., E. Lake Rd., Erie, Pa.]





Above: Rings
Left: Pump

Packing Rings

HPAC 14 — "V" packing rings moulded from "Teflon". . . . Rings are available in all sizes and in two designs, one for low pressure and the other for high pressure up to 5,000 psi. Both types are designed to be used against any substance with the temperature range of —90 deg F to +500 deg F. [Manufacturer: Flexrock Co., Packing Div., 3603-K-Filbert St., Philadelphia 4.]

Air Conditioner with Heating Unit

HPAC 15* — Window-type packaged room air conditioner that both cools and heats. . . . New heating element, "Dyna-Heat," is designed to give instant heat without being affected by outside temperatures. Supplementary heat is provided when central heating system is not in use. A single control knob switches the unit to any one of seven levels of conditioning. A four-direction air louver system is included. [Manufacturer: Mitchell Mfg. Co., 2525 N. Clybourn Ave., Chicago.]

Window Unit

Feeder

Chemical Feed System

HPAC 16 — Packaged chemical feed system for reducing field piping. . . . Unit consists of a 50 to 500 gallon carbon steel chemical solution tank mounted over a "Controlled Volume Pump." Piping is supplied for the suction line, with valves and sight gage for reading liquid level. The pumps are available in simplex or duplex models, airpowered or motor-driven. Capacities range up to 300 gph and operate against pressures up to 5,000 psi. [Manufacturer: Milton Roy Co., 1371 E. Mermaid Lane, Philadelphia 18.]

Vise Jaw

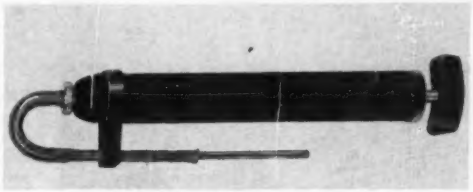
HPAC 17** — "Smoothgrip" vise jaw for tubing or plated pipe. . . . Locks into grip by depressing the handle. It is adjustable to the desired pressure. According to the manufacturer, it will not mar, scratch or distort. Standard jaws fit ISP ⅜ in to ¼ in and type L or K copper tubing from ½ in to 1½ in. Additional sizes are available. Built-in lugs provide for permanent or temporary attachment. [Manufacturer: Robert Austin Corp., 51 Albany St., Boston 11.]

Non-Foaming Oil

HPAC 18 — Non-foaming refrigeration oil to improve lubrication and lengthen compressor life. . . . The manufacturer states that the oil provides maximum lubrication, greater evaporator efficiency, reduced damage to compressor valves, fewer plugged capillaries and less dependency on oil separators. [Manufacturer: Ansul Chemical Co., Refrigeration Div., Marinette, Wis.]

Improved Smoke Tester

HPAC 19* — New "True-Spot Smoker Tester" features a reduction in pulling effort required to operate suction pump. . . . Ease of operation is increased by use of armored rubber tubing between the head of the instrument and the sampling tube. The manufacturer states this enables the operator to draw the flue gas sample, from any position, without danger of damaging the sampling tube.



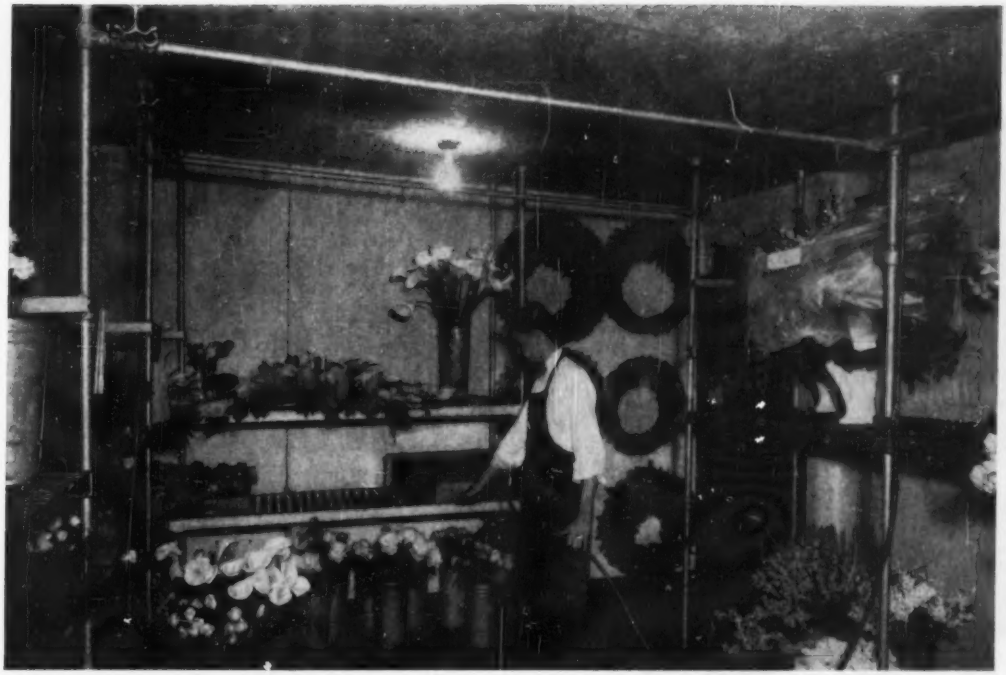
The indicator is designed to provide a smoke spot record of an oil burner installation by pumping a sample of the combustion gases from the furnace flue through filter paper. The discoloration on the paper is compared with fine shading on a scale of soots. [Manufacturer: Bacharach Industrial Instrument Co., 7301 Penn Ave., Pittsburgh 8.]

Pressure Regulator and Filter

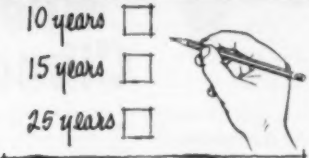
HPAC 20 — Combination pressure regulator and filter in a single unit. . . . Line pressure up to 150 psi can be reduced and maintained at any regulated output pressure from 0 to 35 psi without appreciable drift or air consumption, according to the manufacturer. The filter and dripwell, accessible for easy removal and servicing, provide a clean supply of air for pneumatically-operated instruments. [Manufacturer: Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne & Windrim Aves., Philadelphia 44.]

Flow Meter

HPAC 21 — Low differential flow meter for measuring air flow, gas flow or recording the ratio of air flow to gas flow. . . . Adaptable for industrial furnaces and sewage disposal plants, the diaflow meter uses the pilot method of operation in which no load is placed on the measuring element. The measuring element is a differential type diaphragm unit which is designed to accommodate static



How old is the insulation in this cold room?



This florist's cooler room certainly doesn't look its age. Despite severe moisture conditions, the corkboard insulation is still completely dry although it was installed in 1929—23 years ago! It needs no repairs, shows no signs of deterioration, and the finish is practically as good as new.

The room itself is built of two layers of Armstrong's Corkboard, each 2" thick. The wall at the right is a free-standing corkboard partition of the same thickness. Surfaces are finished with portland cement plaster and scored according to standard specifications.

In continuous service for all these 23 years, the room is still highly efficient, holding temperatures of 48° F. at remarkably low refrigerating costs.

Unusual? Not at all. Our records show that hundreds of installations using Armstrong's Corkboard are still performing at peak efficiency after 20, 30, and even 40 years!

It takes top-quality insulating materials and expert application to give long, trouble-free service like this. That's why it pays to contact Armstrong whenever you're planning any low-temperature work. We can take over the entire job for you—from specifications to application by skilled workmen—to insure a dependable, economical job. For further information, contact your near-by Armstrong office or write Armstrong Cork Company, 4412 Concord St., Lancaster, Pa.

Complete Insulation Contract Service

There are many factors that can't be written into an insulation contract, but which can largely determine whether or not the agreement will be entirely satisfactory. They include:

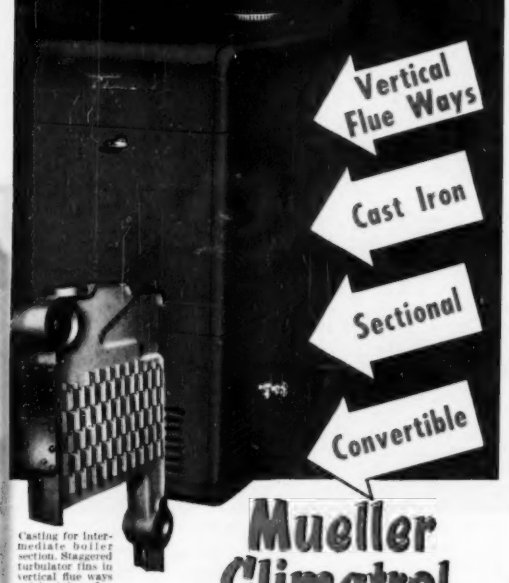
1. Financial responsibility—resources to complete the contract despite any unforeseen events.
2. Integrity—a reputation for quality work and for prompt settlement of any justified complaints.
3. Technical ability — experience, plus technical and research staff to do the job in accordance with best practices.
4. Manpower resources — trained supervisors and workmen able to handle any contract efficiently.
5. Efficiency — ability to deal with problems of accounting, tax provisions, insurance, and workmen's compensation.

You get all these with an Armstrong Contract

ARMSTRONG'S INDUSTRIAL INSULATIONS

For temperatures from 300° below zero to 2800° F.

NEW Oil Boiler
for added business



Casting for intermediate boiler section. Staggered turbulator fins in vertical flue ways swirl rising flue gases for faster, more efficient heat transfer.

Mueller Climatrol

with Outstanding Design Features

- Wide size range for steam, hot water, and hot water supply — inputs of 240,000 Btu to 560,000 Btu. Staggered fins in flue ways turbulate rising gases for greater heat transfer.
- Precision - machined nipple ports and gas-tight vertical flue passages.
- Modern, attractive styling. Easily cleaned from the top without removing casing. Enclosed controls. Casing can be assembled to boiler after boiler is installed and piped.
- Triple tested. Assembled at factory for hydrostatic testing at high pressure and for correct fit. Knocked down for shipment. Conforms to A.S.M.E. code.
- Equipped with Mueller's efficient oil burner which provides efficient combustion, trouble-free operation. A sturdy burner —quiet, vibrationless.

Here it is — an oil-fired boiler with the same superb quality, easy installation features, and money-saving efficiency as the Mueller Climatrol gas-fired boilers.

It's the new Type 35 for steam or hot water; heavy cast iron, sectional, wet nipple boiler — available with tankless heater or can be used for direct hot water supply.

The Type 35 is in a special size range for those larger residential jobs, apartments, small factories, stores — in fact any installation requiring from 240,000 to 560,000 Btu input.

Because the Type 35 is easily converted to gas, it is a perfect answer for areas where people want gas but gas is not now available. Because it is shipped "knocked down", it is easy to get in any basement. Because it has been assembled and "triple tested", you are sure of a low cost installation and long life satisfaction.

Get complete details on the new Mueller oil boiler now. Use the Type 35 on your next job—convince yourself that the Type 35 is a better boiler.

Mail Coupon Today! E-57

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Send me facts and figures — including complete specifications — on your new Type 35 oil-fired boiler.

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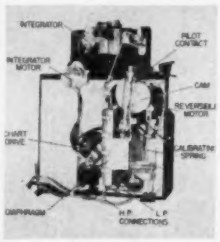
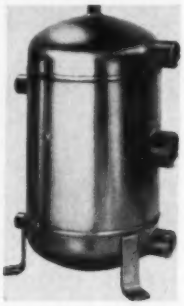
95th Anniversary

FOR GAS ★ FOR OIL ★ FOR COAL

pressures up to 10 lb and differential pressures up to 20 in. water. A single heavy duty fine silver wiping contact converts the diaphragm differential into an electrical impulse which energizes the reversing motor to provide the power required for the meter. [Manufacturer: Hays Corp., 800 E. 8th St., Michigan City, Ind.]





Above: Meter
Right: Condenser

Coil Condenser

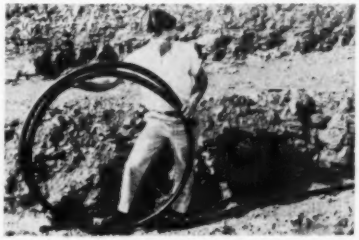
HPAC 22** — "Cross-flow Shell and Coil Condensers," designed for cabinet air conditioners and other installations where space is limited. . . . The vertical 3-ton model is 8⅝ in. O.D. by 16 in. high. The condensers, which have a low water pressure drop, can be used either with city water or with cooling towers. They are available in capacities ranging from 1½ tons through five tons and tested to 300 lb pressure. [Manufacturer: Standard Refrigeration Co., 3535 Fillmore St., Chicago 24.]

Stainless Steel Fitting

HPAC 23 — "Quikupl" stainless steel fitting for joining pipe or tube without threading or welding. . . . Synthetic sealing rings provide pressure-tight joints. The manufacturer states it may be used with schedules 5, 10, 40 and 80 pipe sizes and that it may be used with a variety of tube wall thicknesses as long as the outside diameter remains the same. [Manufacturer: The Cooper Alloy Foundry Co., Bloy St. & Ramsey Ave., Hillside 5, N. J.]

Plastic Pipe

HPAC 24** — Flexible and semi-rigid plastic pipe. . . . The flexible pipe is made in three types: non-toxic, industrial and suction. Made of Polyethylene, the manufacturer states that the advantages are light weight, flexibility,



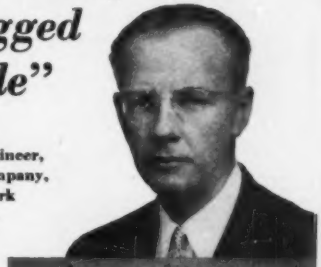
smooth interior and resistance to rot, rust and electrolytic action. The semi-rigid type is made of Butyrate and has greater impact strength and chemical resistance. [Manufacturer: Triangle Conduit & Cable Co., Inc., Plastic Products Div., New Brunswick, N. J.]

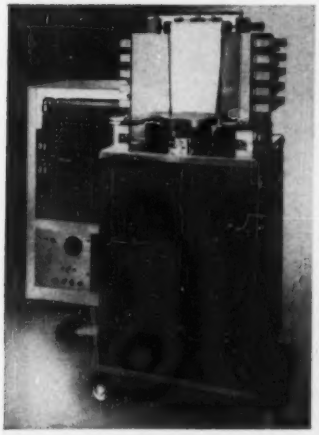
[*Continued on Page* 189]

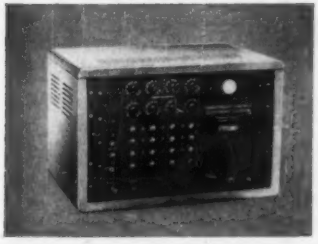
Potter Instrument Company, Inc.

"The 'Flying Typewriter' and all electronic counters require electric components that are rugged and reliable"

says Jack Leight, Sales Engineer, Ward Leonard Electric Company, Mount Vernon, New York







The "Flying Typewriter" is a revolutionary new high-speed electronic printer for data handling, communications, and computing. Developed by the Potter Instrument Company, Inc., Great Neck, New York, it is capable of printing 24,000 characters a minute "on the fly" from a continuously revolving type wheel.

Coupled to an electronic storage or memory unit, the machine first interprets, then prints in familiar typed lines, information taken in coded form from magnetic tape and punched cards or transmitted over narrow channel radio link, telephone and telegraph lines. The entire alphabet, numerals, punctuation and other special symbols are used in printing 300 lines per minute.

Such speed and accuracy in a machine require reliable, rugged electric components. That is why the Potter Instrument Company uses Ward Leonard VITROHM resistors and relays in the electronic counters for the "Flying Typewriter" as well as in the many other types of high-speed electronic counters manufactured by them.

The trouble-free operation of Ward Leonard controls also eliminates many costly and time-consuming repairs which would have to be made by skilled electronic specialists.

Ward Leonard is always ready to put its staff of application engineers to work with you regarding any electrical control.

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Baltimore 18, Md.	Darling Electric Co.
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Chicago 4, Illinois	Ward Leonard Electric Co.
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Hartford 6, Conn.	Ward Leonard Electric Co.
Houston 1, Texas	Bronco-Krochy Co., Inc.
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Knoxville, Tennessee	John G. Pettyjohn
Los Angeles 13, Calif.	Ward Leonard Electric Co.
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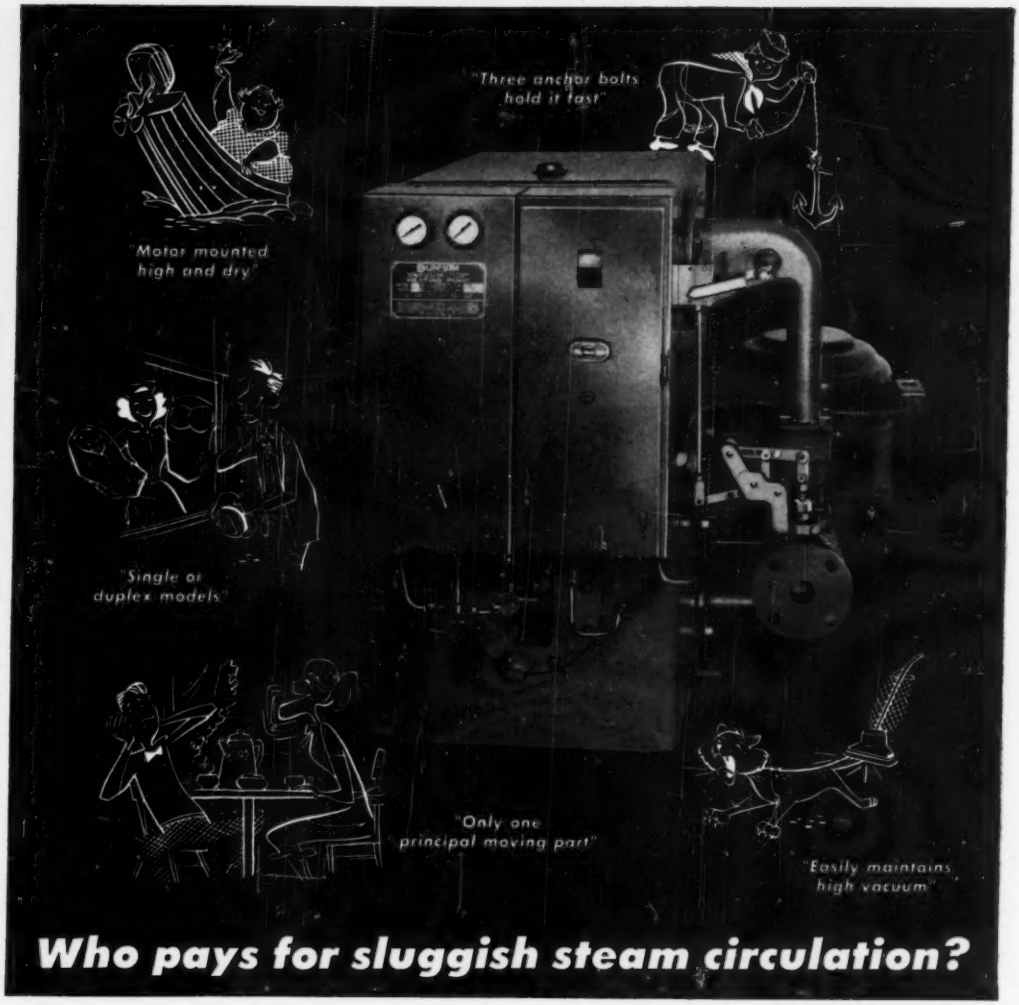

"Three anchor bolts hold it fast"
"Motor mounted high and dry"
"Single or duplex models"
"Only one principal moving part"
"Easily maintains high vacuum"
Who pays for sluggish steam circulation?

You do, of course. Steam in your boiler's not enough. It has to "get around"—rapidly and efficiently if you're to get full value from fuel dollars.

And steam *does* get through your lines rapidly . . . shortens "heat up" periods, too . . . when Dunham Vacuum Pumps are on the job. That's because they are able to regularly *produce and maintain up to 26 inches of vacuum.*

Dunham Vacuum Pumps are simple to install, are ready to operate when piping and wiring connections are made. They go in fast . . . then last and last. Maintenance is amazingly low. Full details are yours for the asking.

Send for Free Bulletin

Bulletin 1401-2 gives full data on pump sizes, construction, capacities. For your free copy write: C. A. Dunham Company, 400 W. Madison Street, Chicago 6, Ill.

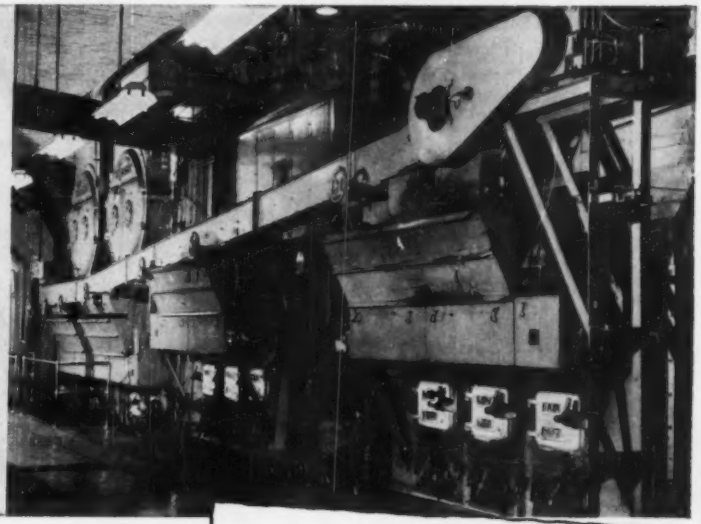
DUNHAM VACUUM PUMPS

ANOTHER QUALITY PRODUCT OF C. A. DUNHAM COMPANY—CHICAGO • TORONTO • LONDON

"WE SAVE MORE THAN $50,000 A YEAR —BY BURNING COAL THE MODERN WAY!

"MODERNIZING OUR COAL INSTALLATION CUT OUR FUEL CONSUMPTION 21.4% . . . LABOR COSTS 60%!"

says Oliver Moses, 3rd, President, Worumbo Manufacturing Company, Lisbon Falls, Maine—makers of WORUMBO FABRICS.



This modernized steam plant will pay for itself in 3 years! The two new boilers shown on the right now carry the complete plant load. They replaced five boilers of the type shown on the extreme left—two of which are still in standby service. The new equipment saves Worumbo nearly 30¢ on every thousand pounds of steam. Automatic, dustless coal and ash handling has helped cut weekly labor costs from $606 to $242! The new plant has a 20% greater capacity—burns 150 *fewer* tons of coal each month.

Today coal can give you more steam per dollar than ever before. With modern combustion equipment, you can get anywhere from 10 to 40% more power from a ton of coal than was possible a few years ago. And with up-to-date automatic coal- and ash-handling systems you can cut labor costs to a minimum.

Building a new plant? Planning to modernize? Then, get the advice of a consulting engineer! He'll show you the way to *big* savings—burning coal in a modern plant designed to meet your specific needs.

Powering your plant with coal makes good sense for the future, too. Coal is the only fuel with really abundant reserves—enough to last for centuries. And this coal is supplied by the world's most efficient and productive coal industry. That's why coal is the only fuel that can offer dependable future supply and greater relative price stability.

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest-cost fuel.

COAL resources in America are adequate for all needs—for hundreds of years to come.

COAL production in the U.S.A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!

There's no REAL substitute for CHASE® COPPER WATER TUBE

For hot and cold water lines

Why risk a substitute when you know you just can't beat Chase Copper Water Tube for domestic hot and cold water lines! Chase Copper Water Tube will not clog with rust. For new construction use Chase Type L, hard temper, and Chase solder-joint fittings. Available in 20 foot straight lengths hard or soft temper. Type L, soft temper, also comes in 60 foot and 100 foot coils that can be snaked behind walls and under flooring.

For underground piping

Look at all the advantages in using Chase Type K Copper Water Tube soft temper, for underground piping! It is so ductile it can be bent around rocks and obstructions. Settling won't harm it as it moves with the earth. Chase Copper Water Tube comes in coils in lengths up to 100 feet. This means fewer fitting connections. All Chase Copper Water Tube is readily bent and cut.

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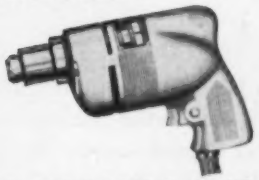
Another 20 year user praises SKIL tools

"SKIL Portable Tools are the most dependable tools in our shop!"

—says **Sidney Zimmerman,** general superintendent,
J. F. ZIMMERMAN & SONS, Dallas, Texas

The J. F. Zimmerman & Sons organization, manufacturer of electric neon signs, has been using SKIL Tools for more than 20 years. Mr. Zimmerman gives his unqualified approval of SKIL performance under all kinds of working conditions. He says, "SKIL Tools have made a big contribution toward production in our shop. We give them real punishment, and they keep right on giving back the kind of performance that built the SKIL reputation. And I *say* this," adds Mr. Zimmerman, "based on our long experience with these tools!"

SKIL Drill—Model 241. ¼" Special Duty drill. Capacity: 0" to ¼" in steel; 0" to ½" in hardwood. Speed: 2250 r.p.m. no-load. Overall length: 11¼". Weight: 4¾ pounds.



SKIL Drill—Model 45. Compact ¼" Standard Duty drill. Capacity 0" to ¼" in steel; 0" to ½" in hardwood. No-load speed: 1800 r.p.m. Overall length: 6⅝". Weight: 3 pounds.

Doyle Hamlin uses a Model 241 SKIL Drill in the fabrication of a base and letter neon sign. He says, "I've used electric tools for 26 years, and no other drill compares with a SKIL Drill. They are compact and very powerful, easiest to handle of them all!"

Donald McCaa removes corrosion from a piece of sheet metal with a SKIL Disc Sander. He says, "SKIL Disc Sanders fill a wide number of uses in our shop. We use them for all kinds of finishing, cleaning and grinding with best results."

See your distributor for complete information or call your nearest SKIL factory branch

SKIL PORTABLE TOOLS

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Arrange now to ATTEND and BENEFIT from this exposition of ideas and progress; the largest of its kind ever held.

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THIS IS FOAMGLAS®

PIPE INSULATION

The only pipe insulation made of cellular glass, it is factory fabricated to insure close fit with equipment and full thickness of insulation. FOAMGLAS pipe and fitting insulation is being used successfully on hot and cold lines, indoors and out, without expensive vapor, moisture, or weather protection. Pipe insulation is available in two types, "Regular," or plain, and "Factory-wrapped" that has a glass cloth membrane to serve as a utility finish where insulation needs protection from extreme impact and abrasion.

There is no other insulation like it—Here's why:

FOAMGLAS is not a fiber, a batt, a blanket, wool or board. It contains no granular or organic material. It is composed entirely of still air sealed in millions of minute glass cells.

FOAMGLAS eliminates the need for extra moisture and vapor barriers. It is practically impervious to fumes, chemicals and many other elements, therefore *retains* its original insulating efficiency throughout exceptionally long service.

FOAMGLAS is an effective barrier to heat flow. It helps maintain predetermined temperatures when installed on roofs and ceilings, in walls and under floors. It is being used successfully in many and varied high and low temperature applications on pipe lines.

FOAMGLAS is light, strong, rigid, durable. It cannot burn. Insects and vermin cannot nest in it, eat into or through it. FOAMGLAS needs no special type weatherproofing when used outdoors.

Pittsburgh Corning Corporation
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Please send me without obligation a sample of FOAMGLAS and your FREE booklet on the use of FOAMGLAS for Piping and Process Equipment.

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Approximately 8600 feet of 1¼" and 1" Republic Continuous Weld Steel Pipe is in these radiant heating floor panels installed in the new St. Ann's Catholic Church, Cleveland Heights, Ohio. J. F. Walsh Co., heating contractor; John T. Butler Co., general contractors; Walker and Weeks, architects.

Made to take the bending and coiling of Radiant Heating Panels

● Republic Steel Pipe is right for radiant heating. Made by Republic's own *improved* continuous weld process, it is highly ductile and easy to fabricate . . . especially suited to close coiling and bending.

For many years, steel pipe has been standard for all types of closed heating systems. Its trouble-free service has proved you need nothing more costly for closed radiant heating systems. And, *today's* Republic Steel Pipe is even better than the pipe which served so well over the past twenty years.

It welds readily by all modern methods. Long lengths speed installation by reducing the number of joints required.

Yes, Republic Steel Pipe meets all requirements for radiant heating—including low first cost and long life. Your Republic Pipe Jobber will be glad to give you latest information on available sizes and current delivery schedules. See him, soon.

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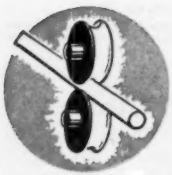


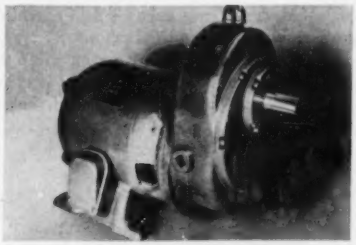
REPUBLIC CONTINUOUS WELD PIPE

Easy to bend, thread and close coil
Easy to weld by all methods
Uniformly ductile
Uniformly strong
Uniformly clean and scale-free
Uniform wall thickness, diameter, concentricity
Economical uniform lengths, extra long lengths
Expansion co-efficient same as concrete and plaster

[*Continued from Page* 180]

Gearmotor

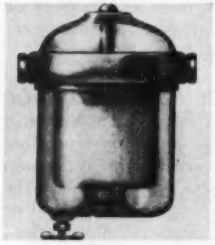
HPAC 25 — "Lifeline," Type B single-reduction gearmotor. . . . It is designed to meet the mounting limitation requirements peculiar to side entry agitators and mixers,



and is suitable for light duty coupled service applications such as fans and pumps. It is available in ratings from 1 to 30 hp, 780 to 420 rpm. [Manufacturer: Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30.]

Fuel Oil Filter

HPAC 26** — "Sette Model KS Fuel Filter," designed to operate with the largest oil burner installations. . . . Incorporates a pre-screening top section in addition to a large ceramic filter element. A drain cock provides for removal of sediment or water in the main filter bowl. Unbreakable transparent top and bowl show when screen or filter need cleaning. The unit is designed for use on suction side of large burner installations and is said to offer very little resistance to flow. [Manufacturer: Marquart Mfg. Co., 1241 High St., Oakland 1, Calif.]



Filter

Controller

Humidity Controller

HPAC 27** — Plug-in controller to operate electrically powered humidifiers and dehumidifiers. . . . The unit is plugged into the control and the control is plugged into a 110 volt wall outlet. The manufacturer states that the control is powerful enough to handle almost all modern types of electric humidifiers and dehumidifiers. The humidity scale extends from 10 percent to 95 percent relative humidity. The controller is equipped for wall mounting. [Manufacturer: Abbeon Supply Co., 179-15 Jamaica Ave., Jamaica 32, N. Y.]

Recirculating Valve

HPAC 28** — Recirculating valve for use in any stream dividing applications of gases, air, salt water, oil and mild chemicals to 125 psi. . . . Externally adjustable spring seating control featuring multiple ball pressure contact against a hardened wear ring is designed to

COMPLETELY ADJUSTABLE
Fusair type A
Here's a ceiling diffuser of exclusive design that has everything. Units provide for rapid and complete mixing by induction, while at the same time creating a slow, continuous air motion throughout the area of throw.
A simple turn of adjustment key effects a complete change in air pattern . . . from horizontal to vertical flow.
The Type A Fusair will function equally well when mounted on high or extremely low ceilings.
Units are provided with 100% volume damper as an integral part of the diffuser.
Write for complete data
ALADDIN HEATING CORPORATION
2272 SAN PABLO AVE., OAKLAND 12, CALIFORNIA
REPRESENTATIVES IN ALL PRINCIPAL CITIES IN THE WEST

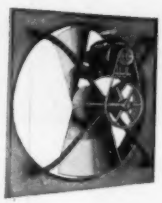
A fan for every need

from

HERMAN NELSON

Direct Drive Unit Blowers *are available in 12 models. Wheel size from 4" to 11". Choice of speeds available in each size. These units may be mounted on floor, wall or ceiling.*

Belt Drive Propeller Fan. *These versatile units deliver maximum amount of air effectively . . . quietly. Operate horizontally or vertically. Wheel diameters from 24" to 54". Capacities up to 36,000 c.f.m.*



Centrifugal Fans for every Class I or Class II use. *Equipped with statically and dynamically balanced air wheels of most advanced design. More than a hundred sizes and speeds. Extra quiet in operation.*

ACCESSORIES

All Herman Nelson Centrifugal Fans and Unit Blowers are available for any discharge and rotation. Weatherproof covers, vibration dampeners, access doors, drain connections, inlet screens, inlet vane control, outlet dampeners and acid resistant finish available.

AAF herman nelson

Write for detailed information about any type Herman Nelson Fan to Dept. HP-12.

American Air Filter

COMPANY, INC.
HEATING AND VENTILATING DEPT.
LOUISVILLE 8, KENTUCKY

provide a leakproof condition and reduce internal wear to a minimum. Flange connections are available for either male or female thread adaptation. [Manufacturer: Ardee Mfg. Co., 840 N. Seward St., Los Angeles 38.]

Pressure Gage

HPAC 29—"Model P" test gage used in checking pressure controllers, recorders and indicators. . . . The 6 in. gage is made in ranges of 0-30 in. Hg vacuum up to 0-10,000 psig. According to the manufacturer, it is guaranteed accurate within ½ of 1 percent of the total scale at any

point throughout its range. Tapered pipe male thread connections are provided. [Manufacturer: The Foxboro Co., 106 Neponset Ave., Foxboro, Mass.]

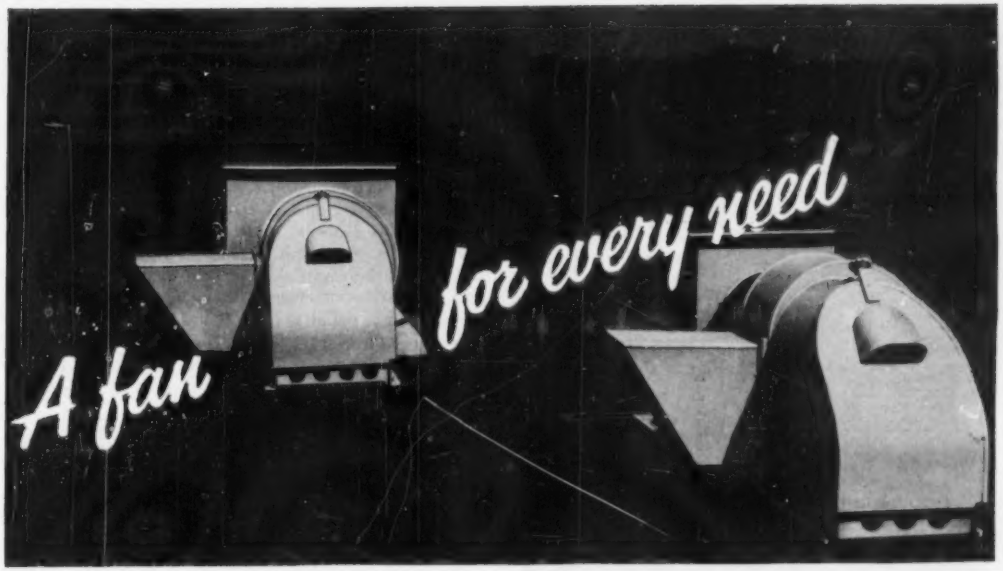
EQUIPMENT BRIEFS . . . .

TEMPERATURE TRANSMITTER consisting of a resistance thermometer element and thermometer adapter unit. The adapter unit converts resistance changes in the thermometer element to a proportional signal voltage. Known as "Type T2T Autronic Temperature Transmitter," it features a removable range card giving a variety of spans in Fahrenheit and Centigrade. [Manufacturer: The Swartwout Co., 18511 Euclid Ave., Cleveland 12.]

Development of a *PNEUMATIC REMOTE CONTROL* has made possible variations in speed of U. S. Varidrive motors. The control consists of an air operated positioning unit and an air valve which remotely controls the unit. Pedal, lever, cam or wheel valves are available. The positioning unit operates with an air pressure of 60 or 100 psi. [Manufacturer: U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles 54.]

FIVE-TYPE MULTI-PURPOSE HOSE LINE, which according to the manufacturer, may take the place of as many as seven types of hose. Each type is color coded for ease of identification. A multi-purpose selection chart is available showing pressures and the different kinds of service for which each hose type is recommended. [Manufacturer: Flexrock Co., 3603 - K - Filbert St., Mechanical Packing Div., Philadelphia 4.]

PORTABLE TEMPERATURE CONTROLLER controls temperatures, blowers, fans and agiators. Unit operates by plugging the instrument into a wall outlet and plugging the unit to be controlled into the controller. True temperature is indicated by upper pointer and may be controlled by setting lower pointer to the correct scale position by means of an external setting knob. [Manufacturer: Taco West Corp. 525 N. Noble St., Chicago 22.]



...FROM

HERMAN NELSON

Here is the most diversified line of packaged centrifugal fans available. There are 103 models with capacities from 360 to 18,300 c.f.m. There are direct drive, belt drive, slow speed and non-overloading types, each carefully designed to do a specific job well. More and more architects, engineers and contractors are specifying and installing Herman Nelson Unit Blowers for the wide range of models insures a unit of the exact capacity needed. Herman Nelson Unit Blowers are compact, easy to install and have inherent ability to deliver or exhaust large quantities of air efficiently.

Herman Nelson Unit Blowers pace the field because constant engineering development and research has resulted in functional, highly efficient units—the result of 45 years of experience in the production of heating and ventilating equipment.

You can judge a unit blower by its fan wheel

The heart of every unit blower is its fan wheel and here is where Herman Nelson superior engineering shows up. All the latest findings of aerodynamic science are put to work in the design of these fan wheels.

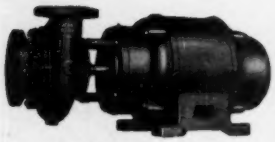
Every fan wheel installed in Herman Nelson Unit Blowers is statically and dynamically balanced before assembly. After assembly, the entire unit is carefully tested at the speed it is to operate within the system. It is also tested at maximum recommended speeds.

AAF herman nelson

American Air Filter COMPANY, INC.

HEATING AND VENTILATING DEPT.

LOUISVILLE 8, KENTUCKY

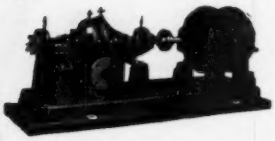


CLOSE-COUPLED PUMPS

A real space-saving design with no sacrifice in durability and efficiency. For clear water, but can be had in special alloys. Bulletin 975-B.

SUMP PUMPS

Self-contained vertical units ready to install. Rugged, trouble-free, with ball bearing thrust and enclosed shaft. Bulletin 963-F.

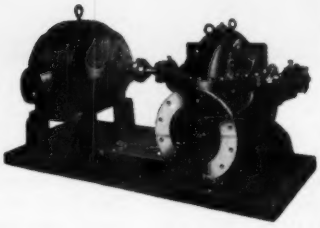


TYPE "RR" PUMPS

For handling clear water, any temperature, at high pressures. Widely used for boiler feed. Rugged, efficient. Bulletin 980-B.

DOUBLE SUCTION PUMPS

For top performance on clear water jobs, including air washers, these are of the finest materials and construction. Bulletin 955-N.



"Buffalo" PUMPS

MEAN MONEY SAVED

THROUGH TROUBLE AVOIDED

True economy in pumping is in the pump you can install—and practically forget! "Buffalo" has always built such pumps. First cost may be a few dollars more than the "low-bidder" pump, but careful, sound "Buffalo" design and construction has always paid for itself in (1) longer years on the job, (2) fewer shutdowns, and (3) high efficiency.

As the pictures show, you can pick a "Buffalo" centrifugal pump that's tailor-made for your job. *WRITE FOR BULLETINS!*

"Buffalo" PUMPS, INC.

171 MORTIMER STREET BUFFALO, N. Y

Subsidiary of Buffalo Forge Company

Canada Pumps, Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID

WE HEAR THAT . . .

THE TRANE CO. is building a $1 million "House of Weather Magic." The new research and testing laboratory will include facilities for duplicating temperature, humidity, pressure and air movement conditions anywhere in the world. According to company officials, it will probably be the largest in the world devoted primarily to the science of heat exchange. Special feature of the laboratory will include model rooms to study heating, cooling, ventilation and humidity control for schools, hospitals, hotels, offices and homes. There will also be "cold rooms" to create sub-zero conditions. Other features to be included are wind tunnels and a sound isolated "quiet room." Parts of the laboratory will be placed in service during the summer of 1953 while major equipment will be installed through 1953 and 1954.

The *AMERICAN GILSONITE CO.* is opening a national sales office in New York with *AARON P. DOWLER*, former vice president of the Cork Insulation Co., as general sales manager.

Proposed consolidation of the *U. S. MACHINE CORP.* with *STEWART-WARNER CORP.* was announced by the presidents of both companies. The plan provides for acquisition by Stewart-Warner of all assets of U. S. Machine in exchange for Stewart-Warner capital stock, and the distribution of this stock by U. S. Machine to its stockholders. The plan has been approved by the boards of the two companies and was submitted for approval at a meeting of U. S. Machine stockholders on November 25.

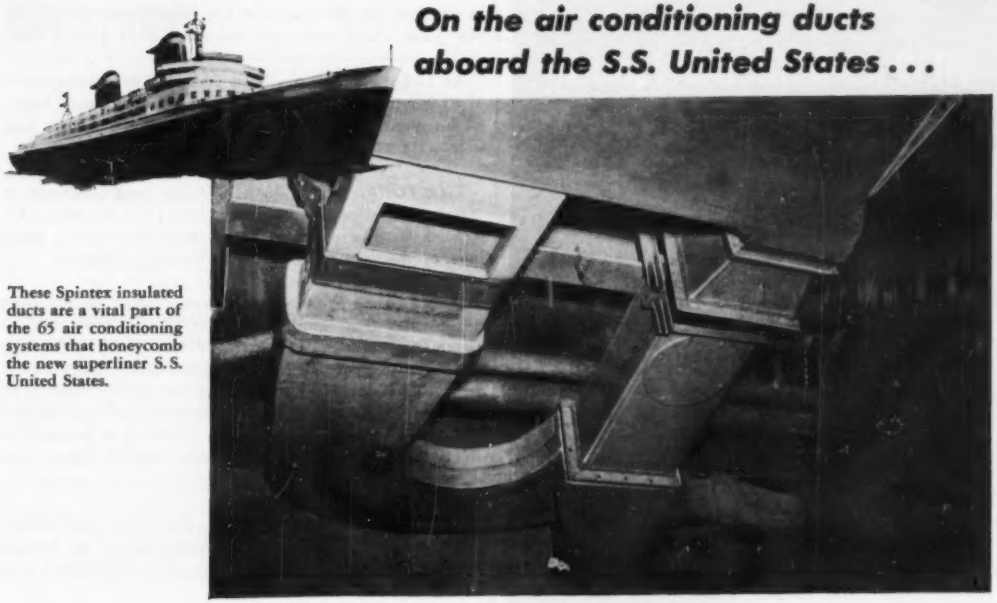
The Rules and Conditions for the sixth annual competition of the Engineering Undergraduate Award Program have been released by the *JAMES F. LINCOLN ARC WELDING FOUNDATION*. Forty-six awards will be made for the best designs of a machine, machine component, structure or structural part that has been designed for welded construction. Three grand awards will be made to the best of the program designs. All entries will be limited to no more than 20 pages. A total of $6,750 will be awarded. The Rules and Conditions booklet, available from the Lincoln Foundation in Cleveland, gives suggestion for subject matter, a bibliography and previous award titles illustrated with drawings.

Railroad baggage cars fitted out as "exhibit halls on wheels" are being used by the major appliance division of the *GENERAL ELECTRIC CO.* to introduce its 1953 line. Two trains are scheduled to visit 16 cities throughout the country.

JRS-TALON TOOLS has announced that their swedging tools now are packed in a protective screw top clear plastic tube to provide a permanent tool case.

SHENANGO AGALOY TUBE CO. of Sharon, Pa., has announced the acquisition of Koldweld Products, Inc.

On the air conditioning ducts aboard the S.S. United States . . .



These Spintex insulated ducts are a vital part of the 65 air conditioning systems that honeycomb the new superliner S. S. United States.

NEW J-M *Spintex* INSULATION CONSERVES FUEL AND POWER

MILES OF DUCTS . . . a vital part of the 65 air conditioning systems that honeycomb the S. S. United States . . . are insulated with Johns-Manville Spintex. This insulation was selected because it makes possible maximum passenger comfort at minimum operating cost.

Low thermal conductivity . . . plus resistance to moisture, fire, rot and mold growth . . . make Spintex the most effective insulation for guarding against heat transfer and moisture accumulation.

Spintex in flexible and semi-rigid types, plus rigid Rock Cork* and Zerolite*, form a team of Johns-Manville insulations for air conditioning ducts that meet every industrial requirement. Basically mineral products, each insulation has its particular characteristics that make it specially suitable for a specific air conditioning service. All three have the low heat transfer properties needed for high insulating efficiency. Properly installed, these insulations for air conditioning ducts will perform their function effectively for the entire life of the equipment on which they are applied.

Since proper application is so essential to the peak performance of any insulation, Johns-Manville offers industry the services of experienced installation contractors who have made a career of solving complex insulation problems.

J-M Insulation Engineers and J-M Insulation Contractors are conveniently located. They stand ready to combine their talents and give you an insulation job that will pay off your initial investment with maximum fuel savings.

Why not let us send you a free copy of Brochure IN-135A which gives all the facts about Johns-Manville Insulations for Air Conditioning Ducts? Write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay Street, Toronto 1, Ontario.

*Reg. U. S. Pat. Off.

Applying Johns-Manville Spintex insulation on one of the ducts aboard the S. S. United States during construction at the Newport News Shipbuilding and Dry Dock Company. Johns-Manville Insulation Contractors throughout the country know Spintex and other J-M insulations as *quality* products, and take pride in applying them properly for peak performance.

Johns-Manville *FIRST IN* INSULATION

MATERIALS • ENGINEERING • APPLICATION

NEW smoothness... NEW efficiency in powder-actuated fastening...

Ramset

JOBMASTER

SEE THESE NEW FEATURES:

- 1-PIECE TOOL, *for faster loading*
- TRIGGER ACTION, *for easy operation*
- PORTED BARREL, *to reduce spall*
- ANGLE-FIRE CONTROL, *for straight penetration*
- VISI-CHEK BUTTON, *for quick inspection*
- *Plus exclusive, proved-in-use* ROTO-SET SAFETY SHIELD, *for accurate positioning*

Faster, lighter, easier handled, the new RAMSET JOBMASTER sets a record pace for steel and concrete fastenings. Properly trained workmen quickly become skilled operators because of smooth, simple, natural motions of loading, placing, firing. Positive controls bring improved accuracy and efficiency ... and still lower fastening costs. Ask your dealer for demonstration of how RAMSET's years of pioneering have made the new JOBMASTER the proved-in-performance leader.

Ramset Fasteners, Inc.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO

ASK FOR DEMONSTRATION TODAY!

In addition, the Shenango Co. has begun construction of a new plant which will cover six acres on a 17-acre plot.

An award of merit has been presented to the employees of *PENN CONTROLS, INC.* by the National Safety Council for one million man-hours of operation without a lost-time accident.

THE TORRINGTON MFG. CO. has been presented an "Oscar of Industry," for taking first place honors in Financial World's annual report competition among members of the international Metal Products Industry.

A new, completely air conditioned plant representing an investment of more than $7,000,000 will be devoted to the manufacture of *CARRIER CORP.'s* 1953 line of residential air conditioning and other unitary equipment. The new plant contains approximately 400,000 sq ft of space. Further expansion plans of the company have resulted in the acquisition of a 2,500 sq ft building to house both direct and dealer sales branch offices plus warehouse facilities.

THE AIR CONDITIONING BLOWER MANUFACTURERS ASSOCIATION is the new name of the Furnace Blower Manufacturers Assoc. The address is 2300 Payne Ave., Cleveland 14.

STEWART E. LAUER, president of *YORK CORP.,* and a national vice president of the National Association of Manufacturers, was given an honoray doctor of laws degree during Founder's Day ceremonies at Ursinus College at York, Pa.

TRIANGLE CONDUIT & CABLE CO., INC. is entering the copper and brass tubing field with construction of a new mill at New Brunswick, N. J. scheduled to be completed in May 1953.

Five new district warehouses have been established by *PENN CONTROLS, INC.* The new warehouses are in the key distribution centers in the Boston, New York, Philadelphia, Cleveland and San Francisco areas.

TRION, INC. has appointed two new representatives: *JAMES B. RISHEL CO.,* Dayton, who will cover 13 counties in Ohio and four Indiana counties; *PEERLESS SALES CO.,* Little Rock, will represent the company in most of the state of Arkansas.

SCAIFE CO. is celebrating its 150th anniversary this year. Although no formal ceremonies have been planned, a brief program was given on November 20 formally opening the new office building in Oakmont, Pa. An open-house was held for employees and their families.

Construction has begun on a new aluminum reduction plant in Arkadelphia, Ark. by the *REYNOLDS METALS CO.* To be known as the Patterson Plant, after Robert P. Patterson, late Secretary of War and member of the company's board, it will have a yearly capacity of 110,000,000 lb of aluminum. The plant is scheduled to be completed in July 1953.

WHO'S WHAT

R. L. LLOYD has been appointed general manager of advertising and *R. A. WHEELER* assistant general manager of advertising of the *INTERNATIONAL NICKEL CO., INC.* In consolidating into one department the advertising sections of the Nickel Sales and Inco Nickel Alloys Depts. the following other appointments were made: *M. J. PHILLIPS*, assistant to the general manager of advertising and *H. S. LEWIS* and *A. P. MORE*, assistant managers of advertising.

MAYNARD H. SNODGRASS has been named as vice-president-sales of the *DETROIT STOKER CO.* He formerly was sales manager of the New York district. Another appointment announced by the company is that of *GEORGE S. HODGES*, who will be sales manager-Detroit district.

DONALD W. DAILEY, one of the nation's foremost designers, has been named a vice president of *SERVEL, INC.* He came to the company two years ago as product manager. Prior to this, Mr. Dailey had served as designer for a number of appliance firms.

Several research and development engineers of the *YORK CORP.* have been elevated to newly created positions of engineering managers. The new managers and the products under their supervision are: *S. B. NISSLEY*, reciprocating compressors; *R. D. BLUM*, central station air conditioning; *R. A. CHADBURN*, heat exchange equipment; *J. H. ANDERSON*, turbo compressors; *S. P. SOLING*, engineered applications; *P. B. MOORE*, single room air conditioners; *A. E. DIEHL*, self-contained air conditioners; *H. A. BRYSSELBOUT*, ice makers, and *P. G. THAYER*, hermetic compressors. *RODNEY F. LAUER* continues as vice president in charge of engineering and research with *J. C. CONSLEY* as chief engineer. *B. E. JAMES*, formerly a vice president with McQuay, Inc., has been named assistant chief engineer in charge of packaged products. *J. R. CHAMBERLAIN* is assistant chief engineer in charge of industrial products, *F. J. ALLEN* has been appointed manager of the corporation's engineering and chemical laboratories. *J. P. HARE* continues as chief draftsman.

ALLAN W. COX has been appointed manager of low-temperature insulation sales for *OWENS-CORNING FIBERGLAS CORP.* He was with the Cork Insulation Co. for more than 16 years.

J. H. FRANKFORT now is chief project engineer for *WALTER KIDDE NUCLEAR LABORATORIES.* Prior to this appointment he was associated with the atomic energy division of the H. K. Ferguson Co.

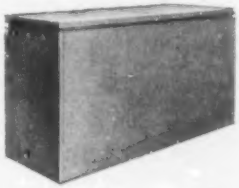
C. ROBERT MARANVILLE, formerly assistant to the works manager of the Holyoke, Mass. plant of *WORTHINGTON CORP.*, has been elected assistant treasurer of

Winstanley Baptist Church of East St. Louis, Illinois installed three DOLE Ice-Cel units in their church basement to provide air conditioning for the congregation. This installation has given year-round comfort not only to the congregation of 1,200 but to the Young People's Class of 75.

"Aside from having a well regulated temperature in our auditorium the year round," to quote Pastor Purdue, "we are enabled to keep our windows and doors closed in the summer which eliminates noise and mosquitoes."

DOLE Ice-Cels are ideal for churches, cafeterias, halls, mortuaries, offices and retail stores where the load is of short duration and Ice-Cels can be charged at off-peak hours with a smaller, less costly condensing unit.

DOC DOLECO Says- The best way to improve church attendance is to make the congregation comfortable with Ice-Cel cooling.



Ask for Catalog F-12.

25th Anniversary 1927-1952

DOLE REFRIGERATING COMPANY

5910 N. Pulaski Rd. • Chicago 30, Ill.
103 Park Ave. New York 17

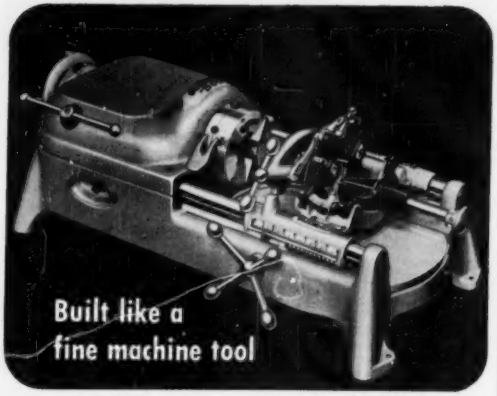
In Canada: Dole Refrigerating Products Limited, 44 Elgin Street, Brantford, Ontario.

Most For Your Money

"THE GREAT NEW"

RIDGID 500

PIPE & BOLT THREADING MACHINE



Full of typical RIDGID improvements

- Range ⅛" to 2" pipe; ¼" to 2" bolts.
- Cutting, threading and reaming tools operate independently and right up to chuck, swing up out of way when not in use.
- New RIDGID quick-opening quadritype, dualtype and monotype die heads save time and work.
- Concealed oil system, reversible pump, no priming.
- More than 20 other efficiency improvements—see this remarkable new RIDGID "500" at your Supply House!

THE RIDGE TOOL CO. • ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

the corporation. *IRVING AUGUST*, formerly superintendent of the plant in Denver, has been appointed assistant to the works manager of the plant in Holyoke. *MERRIL BERMAN*, who most recently has been a product engineer at the plant in Harrison, N. J., succeeds Mr. August.

DOMENICK SAPONARA has been appointed to the engineering staff of the *TIMKEN SILENT AUTOMATIC DIV.* His main duties will be work with gas-fired heating equipment.

W. C. McCORD, president of *UNITED STATES RADIATOR CORP.*, has announced the election of two new vice presidents, *J. ROY KNOX* in charge of U. S. Div. Sales, and *E. J. GRADY* in charge of Pacific Boiler Div. Sales. Mr. Knox has been general sales manager of the U. S. division for the past three years. Mr. Grady has been general sales manager of the Pacific division since 1946.

R. D. WASSERMAN, president of *EUTECTIC WELDING ALLOYS CORP.*, has been elected to membership in the Young President's Organization. To be a member of this group, a man must have become president, before reaching the age of 39, of an industrial or service corporation doing a minimum of $1 million gross business annually.

F. E. SUDER has been named general manager of the *JARECKI INTERNATIONAL SUPPLY DIV.* of the *H. K. PORTER CO., INC.*

Establishment of a specialty refrigeration products department to have responsibility for room air conditioner operations and home food freezers has been announced by the *GENERAL ELECTRIC CO.* major appliance division. *HAROLD B. DONLEY*, who headed the now discontinued room cooler department, will be general manager of the new department. The room air conditioner business was transferred from the air conditioning division at Bloomfield, N. J., to the major appliance division at Louisville, last January. Food freezer operations formerly were a part of the household refrigerator department. According to *CLARENCE H. LINDER*, general manager of the division, the regrouping was done to give a better balance of operations for the division's product departments. Mr. Donley announced that three new executive appointments for the new department are: *J. HAROLD ERICKSON*, formerly manager of finance for the room cooler departments will hold the same position in the new department; *JAMES F. YOUNG*, formerly division engineer for food freezers at Erie, Pa., was named manager of engineering, and *ROY JOHNSON*, former superintendent of food freezer manufacturing at the Erie works, was appointed manager of manufacturing.

ERIC R. SEABLOOM, supervisor of field engineering for the Crane Co., has been elected first vice president of the *AMERICAN WELDING SOCIETY*, for 1952-53. Other Society officers named are: *J. H. HUMBERSTONE*,

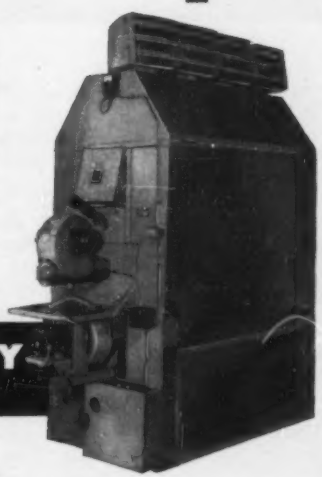
The Quickest, Most Economical Way to Raise a Thermometer

No matter how you figure, Olson direct fired heaters are your answer. Instant heat, where and when it's needed, completely automatic and unattended. The long list of present users agree, Olson is the quickest, most economical form of space heating, by far.

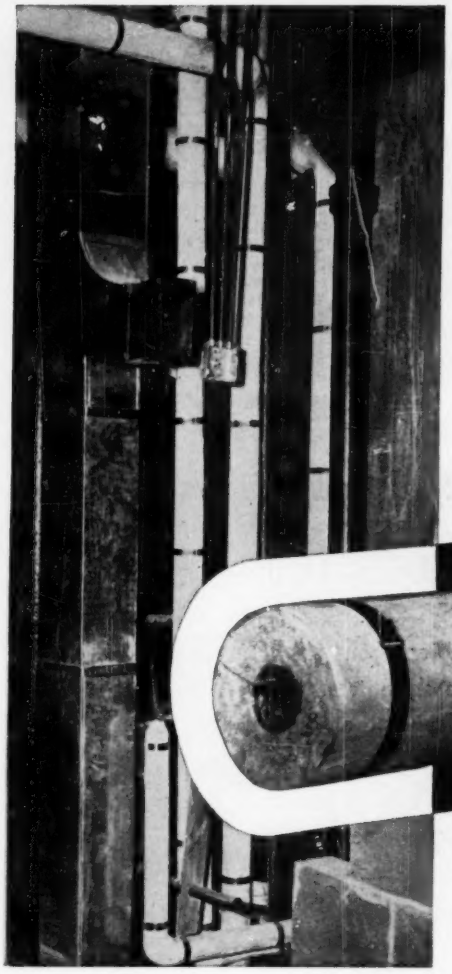
Olson engineers are always happy to talk over your special problems such as "make up" air for drying, painting or other special adaptations. . . . Tempered "make up" air to rid working areas of noxious fumes and harmful industrial dusts.

Get the facts on Olson's low initial cost and simple installation. You'll also find an Olson's flexability can be applied to most any position or location. This form will bring you an illustrated catalog.

ARTHUR A. OLSON & COMPANY
CANFIELD, OHIO
Please send me Olson Direct Fired Heater Catalog.
Name.....
Firm.....
Address.....
City.....State.....

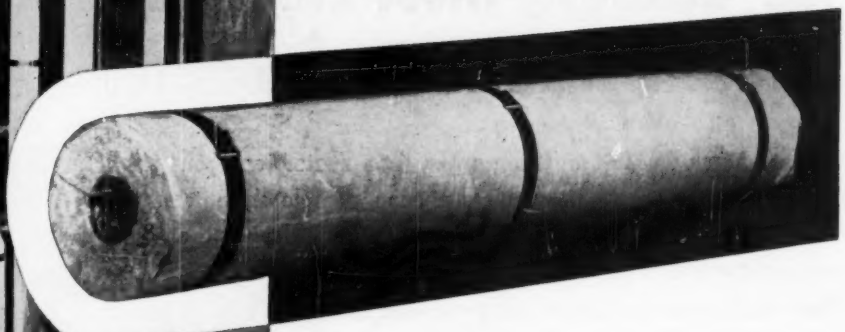


ARTHUR A. OLSON & COMPANY
BROAD ST. CANFIELD, OHIO



YOU SAVE FROM THE VERY BEGINNING WITH

Amocel



...the easy-to-use, long lasting pipe insulation

Probably no one will ever again need to see this installation of long-lasting Amocel, for "out of sight means out of mind" with this durable insulation. There's no concern about replacement, because Amocel lasts the life of the building, so steam and hot water lines need not be accessible for insulation maintenance. Amocel is Unarco's economical pipe insulation for all commercial uses up to 600°F. temperature. For higher temperatures—up to 1200°—specify Unarco Unibestos. Phone your nearby Unarco Distributor for information and from-stock deliveries. *Write for Bulletin 76-109.*

UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. A-12 332 SOUTH MICHIGAN AVENUE • CHICAGO 4, ILLINOIS

UNARCO

Distributor of the Month

Sacomo Manufacturing Co.

38 BLUXOME STREET

SAN FRANCISCO, CALIFORNIA

In the Western States, the Sacomo Manufacturing Company stands ready to serve you with a complete line of Unarco Insulations, Textiles and Special Fabrications.

For years, the management and personnel of the Sacomo Company has cooperated closely with Industrial, Commercial and Marine Users. Sacomo has firmly established an outstanding reputation for sound engineering service and the highest quality products.

If you are located in California, Nevada, Utah, Arizona, Western Wyoming, Western Colorado, or Southern Idaho, write or call the Sacomo Company. The telephone number is YUkon 6-1537.

INDUSTRIAL

Insulations

PRODUCTS OF

UNION ASBESTOS & RUBBER COMPANY

vice president of the Air Reduction Co., Inc., second vice president; *GAIRALD H. GARRETT*, vice president of the Thompson Pipe & Steel Co., director at large; *ISADORE MORRISON*, vice president of Morrison Steel Products, Inc., member at large of Board of Directors; *J. E. DATO*, assistant manager for Linde Air Products Co., vice president of the welding society's mid-southern district; *JOHN H. BLANKENBUEHLER*, design engineer for Hobart Brothers Co., vice president of the central district. For meritorious achievements in the art of welding, the Samuel Wylie Miller Memorial Medal was presented *O. B. J. FRASER*, assistant manager of the Development and Research Div. of the International Nickel Co., Inc.

W. L. NEWHALL has been appointed director of the Department of Research and Development for the *DRAVO CORP.* Named as assistant directors were *C. R. HORTON, JR.* and *A. J. LIEBMAN*. Mr. Newhall, who has been with the company since 1925, had been assistant general manager of the Engineering Works Div.

CHARLES R. HOOK, chairman of the *ARMCO STEEL CORP.*, recently was appointed by Secretary of Commerce Charles Sawyer as a member of a government economic mission to study industrial problems in several European countries. The group is made up of two businessmen and 14 government representatives.

CLOUD WAMPLER, president of *CARRIER CORP.*, has been re-elected a board member of the *NATIONAL INDUSTRIAL CONFERENCE BOARD* for a term of one year. He has been a board member since 1947.

M. J. HACKNEY now is supervisor of sales training of the Air Conditioning Div. of the *GENERAL ELECTRIC CO.* Before joining the company in 1949, Mr. Hackney was assistant sales manager of York Distributors, Inc. New manager of General Electric's Heat Pump Dept. is *C. D. BRADRICK*. Formerly he was manager of industrial engineering for the manufacturing department of the Air Conditioning Div.

WILLIS L. MANNING, research pioneer in the field of sound control, has been elected president of the *NATIONAL NOISE ABATEMENT COUNCIL*. He is president of the Burgess-Manning Co.

A. L. FABENS, JR. now is assistant general manager and production manager of the *RAMSET DIV.* of *OLIN INDUSTRIES, INC.* From 1945 to 1950, Mr. Fabens had been production planning manager for the Buckeye Aluminum Co.

J. Q. A. DOOLITTLE, formerly manager of the Watervliet, N. Y. plant of *ALLEGHENY LUDLUM STEEL CORP.*, has been named assistant to the manager of production for the company. Mr. Doolittle, who will make his headquarters at the executive offices in Pittsburgh, is being succeeded as manager of the Watervliet plant by

Five of the Clarage Heavy Duty Fans in the air conditioning systems of The Upjohn Company's new plant in Kalamazoo. Korfund Twin Rail Fan and Motor bases were used to prevent vibration and noise transmission into the supporting steel deck and the duct work.

...by installing over 200 fans and motors on Duplex bases

Upjohn has long been known for extreme care in the production of fine pharmaceuticals. Therefore, in building their new plant, quiet, spotless working conditions were a prime consideration. This called for 120 complete air conditioning systems with 324 Clarage Heavy Duty fans.

To conserve floor space, The Austin Company, Engineers and Builders planned the installation on suspended platforms and structural steel members under the roof.

Korfund Twin Rail Bases were specified so that no vibration or noise could reach the working areas through the steel decks or through the ducts, and to simplify the installation.

Complete adjustability of the Duplex Twin Rail separate bases for fan and motor made it easy to take care of variations in drive center distances, motor positions and other variables; and the exclusive built-in chocks in these bases guaranteed permanent alignment.

For installation of fans, pumps, compressors, refrigerating and other types of mechanical equipment for both normal and critical operating conditions, basic isolation recommendations are given in Korfund Bulletin G-104. See Sweet's Catalog Files, or write for your free copy today.

If you have a problem, we will be glad to submit recommendations without obligation. A half century of experience is at your disposal. Representatives in principal cities.

THE KORFUND COMPANY, INC.

KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

41-01F Thirty Second Place, Long Island City 1, N.Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

ARTHUR H. HANKS. Mr. Hanks had been manager of the plant's new hot extrusion and stainless tubing department.

DR. RAYMOND H. HARTIGAN has been appointed assistant director of research on the executive staff at the *MELLON INSTITUTE.*

W. E. VERGAN has become special representative of the Railroad Dept. of *GUSTIN-BACON MFG. CO.* Mr. Vergan recently resigned as superintendent of air equipment and diesel operation for the Missouri-Kansas-Texas Railroad which he served for 30 years. He is a former president of the Air Brake Association and the Southwestern Railroad Diesel Club.

DR. D. K. CRAMPTON has been named director of a new Research and Development Dept. at *CHASE BRASS & COPPER CO., INC.* Research will be done on copper, titanium and other metals.

E. W. ERVASTI, who has been sales representative in the St. Louis area for the *WOLVERINE TUBE DIV.* of *CALUMET & HECLA CONSOLIDATED COPPER CO.,* has become manager of industrial sales in Detroit.

JOHN WALLACE, formerly sales manager of Fresh'nd Aire Co., a division of the *CORY CORP.,* has been promoted to midwest division sales manager of the corporation.

SHELLER L. STEINWENDER has been appointed to the new position of vice president-sales of the *SCAIFE CO.* He had been general sales manager of the eastern district for A. O. Smith Corp.

FRANK CHRISTENSON, executive vice president of Refractory & Insulation Corp., recently was elected president and chairman of the board of the *INDUSTRIAL MINERAL FIBER INSTITUTE.*

JOHN M. DUFF has been assigned to the Applied Engineering & Industrial Sales Department of the *RELIANCE ELECTRIC & ENGINEERING CO.* He has been with the company for six years.

GLEN GALLES has been appointed to the newly created post of personnel manager for the *MINNEAPOLIS-HONEYWELL REGULATOR CO.* He has been a member of the company's personnel department since he joined the firm in 1946 and formerly was wage and salary administrator.

HOWARD E. EARL has joined the *SUNDSTRAND MACHINE TOOL CO.* as chief engineer in charge of an engineering department for the development of the company's pneumatic and magnetic products. Prior to this he was director of research of the Eureka Williams Corp.

IN THE TERRITORIES . . .

For *MARLO COIL CO.*, St. Louis—*HAIRSTON AND CO.* are the new representatives in the Atlanta area. *GUY HAIRSTON* will be assisted by *WENDELL ENDSLEY*, sales engineer.

For *BALTIMORE AIRCOIL CO., INC.* — Two new representatives: *GUY W. GENTRY*, Oklahoma and western Arkansas; *HARRY G. MOUAT*, Alabama and northwest Florida.

For *RELIANCE ELECTRIC & ENGINEERING CO.* — *WILLIAM C. McCONNELL* has been transferred from the Detroit office to Cleveland to head a-c motor sales. *ROBERT B. REED*, formerly of the Birmingham, Ala., office succeeds Mr. McConnell. Replacing Mr. Reed is *REX T. WILLARD*, who had been at the sales office in Atlanta.

For *FARR CO.*, Los Angeles — *JOHN S. POWELL* is division sales manager of the central division.

For *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — *WILSON R. COFFMAN* is industrial manager of the Wichita branch office. He had been on the Kansas City, Mo., field staff of the company's Brown Instrument Div. *JAMES E. VANDERVELD* is the industrial sales manager of the Portland, Me., office and *FRED B. AKERSON* is industrial manager of the Portland, Ore., regional office. Mr. Akerson succeeds *LESTER W. WILLIAMS* who has been given important chemical industry assignments in the East.

For *CHASE BRASS & COPPER CO.* — *RALPH H. STROTH* is Indianapolis district manager, serving most of Indiana. *VINCENT MEYER*, formerly Indianapolis district manager, has been appointed to the Chicago sales office.

For *GENERAL CONTROLS CO.* — *B. L. LERCH*, formerly Chicago factory branch office manager, is regional manager for the middle western territory. *RUSSELL STRONGMAN* is regional manager covering factory branch offices in Newark, New York, Hartford and Boston.

For *SERVEL CO.* — *STANDARD SHEET METAL WORKS* of Phoenix is the new distributor for the company's air conditioning products in northern Arizona. *AIR EQUIPMENT DISTRIBUTORS, INC.* is handling distribution for New York City and parts of Long Island.

For *WORTHINGTON CORP.* — *CHARLES V. BENGLE* is air conditioning and refrigeration district representative in Michigan with headquarters in Detroit.

For *PARKER APPLIANCE CO.* — *WILLIAM O. MURRAY* is industrial sales engineer with headquarters in Pittsburgh. He is working with distributors in western Pennsylvania, West Virginia and southeastern Ohio. In

These two compressors, installed in a machinery penthouse on the 11th floor of the Pathé Television Center, New York, are now mounted on Korfund standard steel spring vibro-isolators. The structural steel saddles shown are not ordinarily required, but were used in this case so that original piping could remain unchanged.

...by controlling vibration

When originally installed, each of these two big compressors was mounted on 4 rubber-in-shear rails, which were not the proper isolation for the vibration frequency and floor conditions.

Consequently, vibration transmission through these "mountings" was so bad that it was impossible to use office space on the floor below, and vibration and noise transmitted through the building were picked up on film sound tracks several floors down.

Now, remounted on Engineered Korfund Spring Isolators, the job is entirely satisfactory and has been in operation for the last three years.

Korfund Engineered Vibration Control would have cost no more in the beginning.

A selector chart in Bulletin G-104 gives basic isolation recommendations for both normal and critical operating conditions for pumps, fans, compressors, refrigerating and other types of mechanical equipment. See Sweet's Catalog Files, or write us for your free copy today.

We'll gladly submit recommendations without obligation. A half century of experience is at your disposal.

THE KORFUND COMPANY, INC.

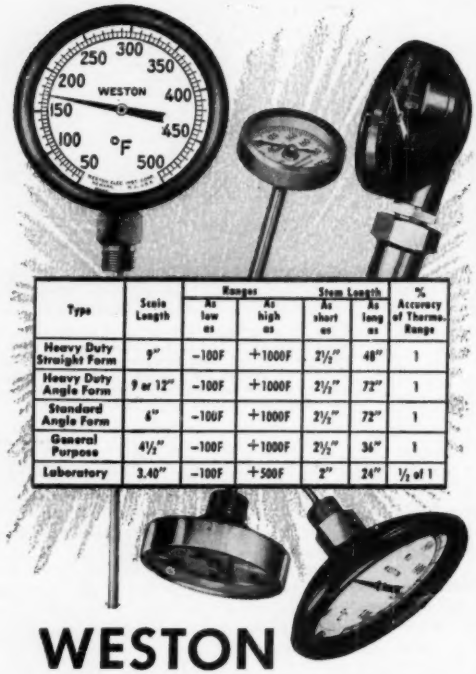
KORFUND VIBRATION CONTROL — SPRINGS — RUBBER — CORK

41-01F Thirty Second Place, Long Island City 1, N. Y.
In Canada: 510 Canal Bank, Ville St. Pierre, Montreal

See us at the International Heating and Ventilating Exposition, Chicago, January 26-30. Booth No. 943.

Available

in broadest selection of types, ranges, stem lengths



Type	Scale Length	Ranges As low as	Ranges As high as	Stem Length As short as	Stem Length As long as	% Accuracy of Thermo. Range
Heavy Duty Straight Form	9"	−100F	+1000F	2½"	48"	1
Heavy Duty Angle Form	9 or 12"	−100F	+1000F	2½"	72"	1
Standard Angle Form	6"	−100F	+1000F	2½"	72"	1
General Purpose	4½"	−100F	+1000F	2½"	36"	1
Laboratory	3.40"	−100F	+500F	2"	24"	½ of 1

WESTON

all-metal THERMOMETERS

WESTON Thermometers give you *all* the advantages of all-metal construction *to an unmatched degree.* The durability of stainless steel stems . . . the readability of large, boldly marked scales . . . the sustained accuracy due to precision manufacture *proved* through the years. Order through your regular jobber, or your local WESTON Representative. Catalog T-13 on request . . . WESTON Electrical Instrument Corporation, 617 Frelinghuysen Ave., Newark 5, New Jersey . . . *manufacturers of Weston and TAGliabue Instruments.*

WESTON

Temperature Instruments INDICATE — RECORD — CONTROL

9288

the St. Louis area, *PETE E. WALKER* is industrial sales engineer. He will be working with the company's distributors in Missouri, Iowa, eastern Kansas, Nebraska and southern Illinois.

For *AMERICAN BRASS CO. — JOHN N. ALLEN* is district sales manager for a new office in Cedar Rapids, Iowa. He had been on the company's Chicago sales staff.

For *UNITED STATES AIR CONDITIONING CORP. — H. E. CULLEY & CO.* of Louisville is the new representative in the territory comprising Kentucky, southern Illinois and southern Indiana.

For *CENTURY ENGINEERING CORP. — TOM G. BRIDGE* is district sales manager with headquarters in Cincinnati. He is directing sales in the east central district which includes southern Ohio and Indiana, Kentucky and eastern West Virginia.

For *BUSH MFG. CO. — AARON R. KAMINSKY* is a sales engineer with headquarters in Dayton from where he will represent both Bush and the *HEAT-X-CHANGER CO.* in western Ohio, Kentucky, and West Virginia areas. *EDGAR L. DISBROW* is taking Mr. Kaminsky's place in New York as application engineer.

For *BIF INDUSTRIES — L. W. ARMSTRONG* is in charge of a new service center in Seattle to handle all-service problems for *BUILDERS-PROVIDENCE, INC.*, flow meters and controllers and *OMEGA MACHINE CO.* dry feeders. The territory covered includes Oregon, Washington, western Idaho and British Columbia and Alberta in Canada.

For *THE SWARTWOUT CO. — ROBERT E. ALEXANDER* is district manager for the new sales office in Cambridge, Mass. established to service Power Plant Equipment and Autronic Control Div. accounts in the New England area. Other changes announced by the company are *GEORGE H. THOMPSON* as the Florida representative and *ALLAN G. BOWRY* as the representative for the company's Industrial Ventilation Div. with headquarters in Cambridge.

For *FAGEOL HEAT MACHINE CO. — LOREN G. BARNES* is district manager for Illinois, Wisconsin and Minnesota with headquarters in Chicago. He was formerly division sales manager of The Universal Gear Corp.

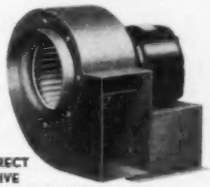
For *GENERAL CONTROLS CO.—R. C. BOEHM* is assistant manager for both the appliance and heating divisions with headquarters at the company's new plant in Skokie, Ill. He will cover the territory east of the Mississippi. Mr. Boehm formerly was manager of the branch office in Birmingham, Ala.

For *PITTSBURGH PLATE GLASS CO.* — two new district sales offices: *PAUL D. KALEY* is district sales

Peerless Electric

certified blower units built with job-matched Peerless motors

MORE PERFORMANCE

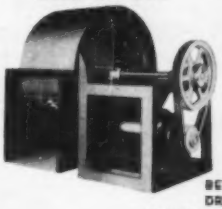


DIRECT DRIVE UTILITY BLOWER

LESS COST

PRESSURE BLOWER

LESS EFFORT



BELT DRIVE UTILITY BLOWER

● Smooth-running efficiency, compactly built around rugged all-metal frames . . . that spells Peerless ready-to-install blower units, built with job-matched Peerless motors.

There's a certified Peerless Blower for your every requirement. Write today for complete catalog. Remember, Peerless offers you faster service, fuller guarantees, longer life. Get the full facts now; judge for yourself!

Fan and Blower Division

THE PEERLESS ELECTRIC COMPANY

1409 West Market St. • Warren, Ohio

Peerless Electric

RIGIDBILT LARGE CAPACITY UNIT COOLERS

● REDUCES NUMBER OF UNITS REQUIRED ● REDUCES PIPING AND ELECTRICAL CONNECTIONS ● FOR STANDARD OR LOW TEMPERATURES (WITH WATER DEFROST) ● EFFICIENT ● ECONOMICAL

FAST DELIVERY!

AVAILABLE RIGIDBILT PRODUCTS

- CEILING TYPE AIR CONDITIONING UNITS
- FLOOR TYPE AIR CONDITIONING UNITS
- VENTILATING UNITS
- DIRECT EXPANSION COOLING COILS
- WATER COOLING COILS
- STANDARD STEAM HEATING COILS
- STEAM DISTRIBUTING TUBE HEATING COILS
- HOT WATER HEATING COILS
- SUSPENDED TYPE UNIT COOLERS FOR ALL REFRIGERANTS
- FLOOR TYPE PRODUCT COOLERS
- SPECIAL COILS FOR ALL REFRIGERANTS

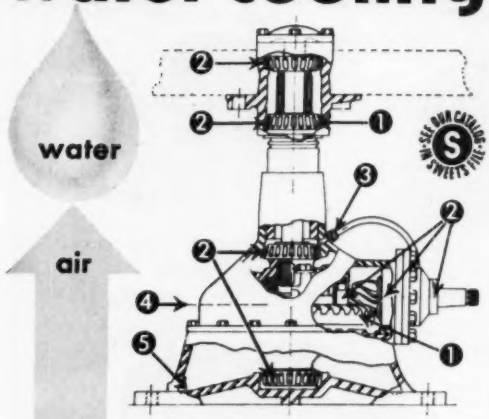
DESIGNED TO MEET THE MOST EXACTING REQUIREMENTS

RIGIDBILT IS BETTER BUILT—Write for Catalog.

RIGIDBILT INC.

2852 W. FULTON ST. CHICAGO 12, ILLINOIS

geared for better water cooling



One of the most vital parts of a water cooling tower is the gear reducer which drives the fan. Smooth, positive power must be transmitted quietly from motor to fan. Water Cooling Equipment Company are the original designers of semi-floating axle gear reducers for water cooling towers, the best type for this use.

Water Cooling Equipment Company gear reducers are the best because:

1. Not a single pound of weight or thrust of the fan is transmitted to the gears. The entire weight and thrust — up to 1500 pounds — is carried by the lower of the two top bearings of the gear case.
2. Seven bearings keep the fan shaft and pinion shaft in perfect alignment.
3. Positive force-feed oil circulation provides the best lubrication for gears and bearings.
4. Large oil capacity assures cooling action on the gears and bearings.
5. The gear case is shaped so that any sludge formed in the oil is thrown out and down where it cannot recirculate over the gears and bearings.

TOWERS OF STRENGTH WCEC

Semi-floating type WCEC gear reducers transmit more horsepower per pound of gear than any other design. All parts of WCEC gear reducers are standard automotive equipment available in moderate sized cities and towns.

Consider these many important facts when you discuss the purchase of a water cooling tower.

WATER COOLING EQUIPMENT COMPANY

MAIN OFFICE • 8601 New Hampshire Ave. • St. Louis 23, Mo.

Fabricating Plants:

St. Louis, Mo. • Arcata, Calif. • Houston, Texas

REPRESENTATIVES IN TWENTY-EIGHT PRINCIPAL CITIES

manager in New York City and *H. J. BYGOTT, JR.* is district sales manager in Washington, D. C.

For *TRANE CO.*, La Crosse, Wis. — *JACK DAVIS* is at the sales office in Jackson, Miss.

For *HAMMEL-DAHL CO.*, Providence — New sales and service representative, *JAMES E. DYER CO.* of Tulsa and Oklahoma City.

For *UNITED STATES AIR CONDITIONING CORP.*— Four new dealers in Tennessee and South Carolina: *RICKER HEATING CO.*, Oak Ridge; *WITHEROW PLUMBING AND TIN SHOP*, Mount Pleasant; *LOCKE HEATING & CONSTRUCTION CO.*, Knoxville, and *CAROLINA HEATING CO., INC.* of Columbia.

For *TRANE CO.* — three sales representatives: *WALTER LAMBERT* and *RICHARD A. MATHEIS* are at the Pittsburgh sales office. *STAN MANGHAM* is at the Atlanta office. Mr. Matheis was formerly associated with the general sales department in the office of the company in La Crosse, Wis.

For *JANITROL DOMESTIC-COMMERCIAL SPACE HEATING DIV.* of *SURFACE COMBUSTION CORP.*— three new field sales representatives: *RICHARD H. BALK*, formerly on special project assignments in the Toledo area, now is in the Columbus territory handling 27 southern Ohio counties: *JAMES W. McAFEE*, sales representative for West Virginia with headquarters in Princeton, W. Va., and *THOMAS J. LANGAN*, sales representative in the Cleveland territory.

For *RADIATOR SPECIALTY CO.* — *RALPH MALLEY* is district representative for the "Solder Seal" line in the Pittsburgh area.

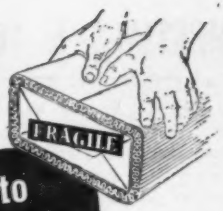
For *TENNEY ENGINEERING, INC.* — *CORBIN AND PLATZ SALES AGENCY* of Kansas City, Kan., will handle the midwest territory.

For *AIR REDUCTION SALES CO.*—*A. S. BLODGET, JR.* is manager of the Pittsburgh district. *E. S. TWINING, JR.*, formerly assistant sales manager of the Philadelphia district, succeeds Mr. Blodget as manager of the Boston district.

For *SURFACE COMBUSTION CORP.* — *OTTO C. GERHARDT* is sales representative for the *JANITROL DOMESTIC-COMMERCIAL DIV.* with headquarters in St. Louis.

For *WAGNER ELECTRIC CORP.* — *ARTHUR H. BEASLEY* is manager of the Memphis sales branch. He succeeds *A. CALLAWAY ALLEN*, who recently became sales manager of the company's electrical division. Mr. Beasley has been with the company since 1936 and most recently was at the Chicago branch.

a *Basic Principle* for protection



developed to ultimate efficiency

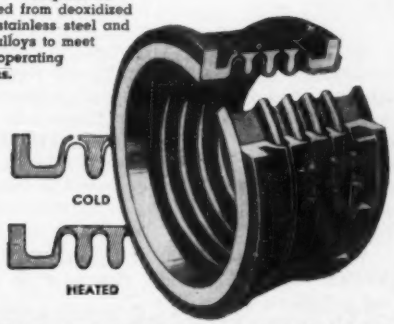
in Badger Expansion Joints

Directed-Flexing Self-Equalizing . . . exclusive features of Badger Expansion Joints

Badger Manufacturing Company developed its *Directed-Flexing, Self-Equalizing* expansion joints with lasting protection to costly equipment in mind. The all-curve pattern of the corrugated member eliminates sharp bends and structure weakening stresses which assure long maintenance-free life.

In combination with the correspondingly shaped Badger Self-Equalizing ring, progressively controlled movement of each corrugation insures a more flexible, longer lasting joint. Buy Badger Joints and you get flexibility, Directed-Flexing Self-Equalizing and these features:

- Packless . . . pressure-tight single tube—requires no maintenance
- Compact . . . approximately the size of flanged fitting
- Special forming . . . no structure-weakening stresses
- Controlled heat treating . . . assures long life
- Wide range of traverse — pressure — temperature Fabricated from deoxidized copper, stainless steel and special alloys to meet various operating conditions.



BADGER MANUFACTURING COMPANY

Original and Sole Manufacturer of Badger Expansion Joints

230 BENT STREET • CAMBRIDGE • MASS.

Any engineer will tell you **Skidmore** offers more pump performance

There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

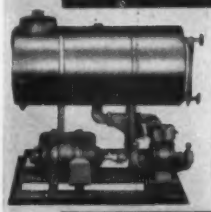
Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

Write for *Bulletin No. 19-A*

TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

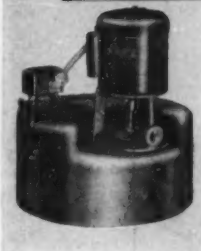
Write for *Bulletin No. 14-A*



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

Write for *Bulletin No. 17*



TYPE CV

Type CV Vertical Pump is ideal where space is limited. This model like every Skidmore Pump is built to meet specific requirements. For the correct solution to your own pump problem consult a Skidmore Heating Pump Specialist.

Write for *Bulletin No. 21*

Sales representatives in principal cities

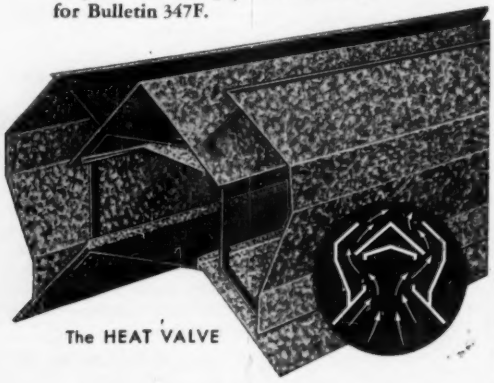
SKIDMORE CORP., ST. JOSEPH, MICHIGAN

SKIDMORE PUMPS

The AIRMOVER

For Low Cost *Natural* Ventilation it's good business to use these Swartwout Ventilators

Beat the cost of power and expensive duct work when *Natural* (gravity) ventilation will do the job. In thousands of industrial and commercial buildings Swartwout AIRMOVER and Swartwout-Dexter HEAT VALVE move enormous quantities of heat, smoke and fumes at *no after-installation cost* except small maintenance. And original cost is economical per square foot of opening. . . . It pays you to get Swartwout help on your ventilating problems. Write for Bulletin 347F.



The HEAT VALVE

18511 Euclid Avenue, Cleveland 12, Ohio

The Swartwout Co.

Roof Ventilators and Ventilating Louvers

POWER PLANT EQUIPMENT • PROCESS INDUSTRY CONTROLS

MEETINGS & CONVENTIONS

IBR SCHOOL OF MODERN HEATING — January 6 to 8, Buffalo; January 13 to 15, Dayton; January 19 to 21, Indianapolis; January 28 to 30, St. Louis; February 3 to 5, Louisville; February 9 to 11, Cleveland. Students wishing further information may obtain it from The Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17.

PLANT MAINTENANCE CONFERENCE AND SHOW — January 19 to 22, 1953, Public Auditorium, Cleveland. Management of the show is Clapp & Poliak, Inc., 341 Madison Ave., New York 17. Sponsored jointly by the American Society of Mechanical Engineers and the Society for the Advancement of Management, it is estimated that some 7,000 products will be shown. There will be 66 sessions, including three panels, 16 sectional conferences, 42 roundtables, four plant tours and a banquet.

NATIONAL HEATING WHOLESALERS ASSOCIATION, INC., 637 Union Commerce Bldg., Cleveland 14 — The annual meeting, January 26 to 28, Congress Hotel, Chicago.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, 62 Worth St., New York 13 — 59th annual meeting, January 26 to 29, Conrad Hilton Hotel, Chicago. See ASHVE Journal Section for details.

11th INTERNATIONAL HEATING & VENTILATING EXPOSITION — THE AIR CONDITIONING EXPOSITION — January 26 to 30, 1953, International Amphitheatre, Chicago. Held under the auspices of The American Society of Heating and Ventilating Engineers. Address inquiries to the exposition management, International Exposition Co., Inc., Grand Central Palace, New York 17.

SHORT COURSE IN CORROSION — University of California, Berkeley. — February 2 to 6, five-day course given by the extension and engineering departments in cooperation with the National Association of Corrosion Engineers.

SECOND ANNUAL INDUSTRIAL VENTILATION CONFERENCE — February 16 to 19, Kellogg Center, Michigan State College, East Lansing. Sponsored by the School of Engineering and the Division of Industrial Health, Michigan Department of Health. Class room sessions, talks and demonstrations on practical application of exhaust systems for the control of industrial contaminants.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS, 1061 M & M Bldg., Houston 2. — Conference and exhibition, March 16 to 20.

AIR POLLUTION CONTROL ASSOCIATION, 4400 Fifth Ave., Mellon Institute Building, Pittsburgh — Annual meeting, May 25 to 28, Lord Baltimore, Baltimore.

The Greater Pittsburgh Airport Terminal Building, the largest in the world, was built under the supervision of the Board of County Commissioners, Allegheny County, Pittsburgh, Penna.

Something New In Air Conditioning! From trap doors in the loading areas, flexible hoses supply electronically-cleaned, conditioned air to flush out plane's cabin.

UNDERGROUND "AIR-LIFT"

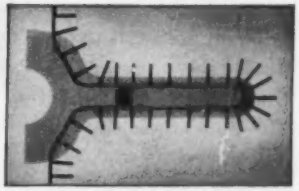
AIR CONDITIONS A PLANE A MINUTE

Now passengers waiting in planes will breathe air as clean and pure as the air at 10,000 feet. Even more, the planes will be air conditioned while on the ground. This unique feature of the world's newest and most modern airport in Pittsburgh can handle a plane a minute.

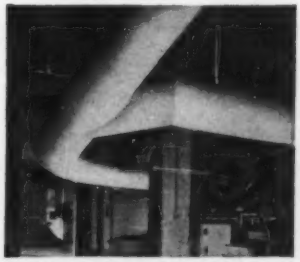
In an underground supply system Westinghouse Precipitron®, the electronic air cleaner, removes dust, pollen, smog —even germs—from the air. Westinghouse Heat Transfer Coils cool, heat or dehumidify the air as required by the weather. Result: Perfect climate inside the parked planes, year 'round.

The Terminal Building is also air conditioned. It's a small city in itself, containing 62 hotel rooms and suites, a theater, bank, post-office, telephone exchange, stores and shops. Fourteen systems serving them are equipped with Westinghouse fans, coils or Precipitron air cleaners.

When you *put air to work*—for air handling, air cleaning or air conditioning—see Westinghouse. A complete product line matches your needs. Call your local Westinghouse-Sturtevant office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Mass.



Constructed like a giant centipede, the supply system pipes conditioned air through underground ducts to loading planes. It can supply 31 planes at once.



These ducts lead to loading areas from the Precipitron in background. Dirt, pollen, germs and smog have been removed electronically.

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J-80240

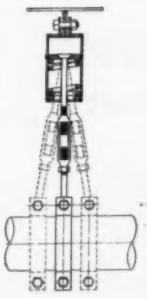
AIR HANDLING

YOUR JOB IS 3/3 DONE WITH...

BLAW-KNOX
FUNCTIONAL HANGERS

Internal swivel action accommodates pipe line movements in ALL DIRECTIONS

The patented Internal Swivel Action, found only in Blaw-Knox Functional Type Spring Hangers, allows *lateral* and *axial* movements within reasonable limits, as well as vertical pipe line movement. This represents a decided improvement over hangers designed for vertical movement only. The pivotal connection within the hanger itself permits the pipe line to move at a considerable angle to the hanger, which is attached to a fixed support.



Because they provide for horizontal movement, Blaw-Knox Functional Hangers help piping engineers solve difficult hanger problems arising from pipe line expansion or contraction, vibration, and pulsations. Catalog No. 51 will give you complete information on Blaw-Knox Pipe Hangers, Vibration Eliminators and Supports—as well as valuable technical data on hanger design. Write for your copy today—no obligation.

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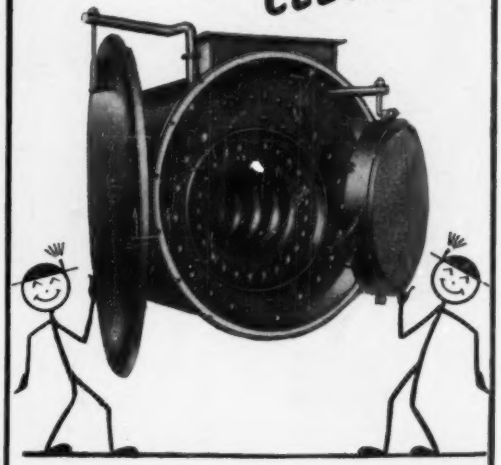
Power Piping and Sprinkler Division
Pittsburgh 33, Pennsylvania

BLAW-KNOX PIONEERS IN THE DEVELOPMENT OF FUNCTIONAL HANGERS VIBRATION ELIMINATORS

AMESTEAM GENERATOR

EASY TO CLEAN!



To Completely Expose Furnace and All Tubes . . . Open One-Piece Rear Flue Cover, Then . . .

Open One-Piece Rear Baffle. There are Ample Clean-Out Doors in Front End, too!

Nineteen Sizes — 10 to 500 h.p.
15# to 200# w.p.
OIL or GAS

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AMES IRON WORKS
BOX G-12 OSWEGO, N. Y.
Builders of Better Boilers Since 1848

NEW BOOKS & REPORTS

New U.L. Air Conditioning Standard

Underwriters' Laboratories, Inc. has published a new edition of the *Standard for Air Conditioning, Commercial and Domestic Refrigeration Equipment, Subject 207 A*, which replaces the Standards for Air Conditioning and Commercial Refrigerating Equipment, Eighth edition, dated February 1946.

This edition has been prepared after careful study by the laboratory staff, consultation with manufacturer's representatives on the Industry Advisory Conference on Refrigeration and submission of two preliminary drafts. Sections of this Standard relating to room air conditioners became effective on all such equipment listed after November 1, 1952. The Standard will become effective on all other equipment listed after October 1, 1953. Prior to that date, a newly submitted appliance will be judged under the requirements of this Standard unless the submittor specifically requests that it be judged under the requirements formerly applicable. However, should he elect this option, the submittor should note that compliance with this Standard will be required to be made before October 1, 1953.

In the intervening period, Underwriters' Laboratories plans to review all air conditioning, commercial and domestic refrigeration equipment now listed and advise manufacturers of any changes necessary to make the products comply fully with the requirements of this Standard.

Some of the revisions, made after the July 1951 draft, include compressor motor temperature limitations, a steel tubing table, test conditions for dehumidifiers and test voltage of motor-operated appliances.

Copies are available on request from Underwriters' Laboratories, National Board of Fire Underwriters, 207 E. Ohio St., Chicago 11.

Welding Ferrous and Non-Ferrous Metals

Weldability of Metals is a 141-page book which explains factors determining weldability, gives causes and cures for hard to weld metals, details welding procedures for steels, nickel, iron, alloys, copper, aluminum and hardfacing. It was reprinted from the 9th Edition of the Procedure Handbook of Arc Welding Design and Practice.

The various types of carbon and alloy steels are described by giving nominal chemical analysis, properties, uses and characteristics. American Welding Society specifications for electrodes used to weld are also given. Complete tabular data, drawings and pictures supplement the text.

Copies may be obtained at 50 cents each from the Lincoln Electric Co., Cleveland 17. Copies ordered from outside the United States are 75 cents, postage paid.

ASTM Symposium on Acoustical Materials

The purpose of this *Symposium* is to discuss briefly the origin and history of the acoustical materials industry and to outline the many and varied problems to be solved. Papers cover problems of sound absorption, maintenance, applications and the relationship of many basic physical properties, all of which are being approached by ASTM

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

Field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

FIELD CONTROL DIVISION

of H. D. Conkey & Company — Mendota, Illinois

UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.

DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

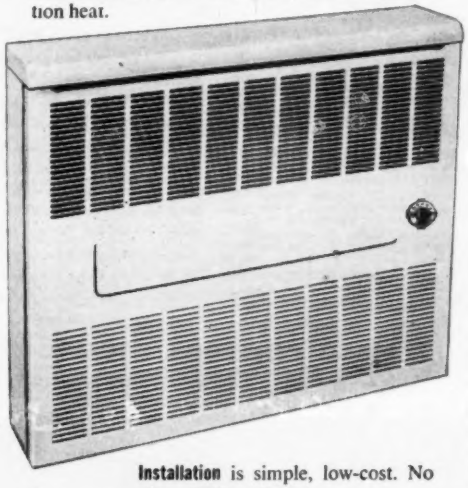
CIRCLE-AIR CONVECTION ELECTRIC HEATING

SOLVES these heating PROBLEMS in your plant...

For "cold" rooms or offices, **CIRCLE AIR** gives **thermostatically controlled** spot heat **where** and **when** needed.

Ideal for off-season heating. **CIRCLE AIR** heats offices when heat is unwanted in plant. No need to work entire heating system.

CIRCLE AIR eliminates dirt collecting, smelly gas space heaters. No odors, no noise, no drafts, no fans with **CIRCLE AIR.** It's healthy, **natural** convection heat.



Installation is simple, low-cost. No pipes, boilers, furnaces.
Maintenance cost is negligible.
Heating unit is **guaranteed** five years.

CIRCLE AIR Convection Electric Heating is the ideal answer to your most both..some heating problems. Its superior design, high efficiency, and low cost of operation make **CIRCLE AIR** a **MUST** in your plant.

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Committee C-20 on Acoustical Materials whose purpose is to formulate suitable test methods and procedures for these materials.

Copies of this 40 page book can be obtained from the headquarters of the American Society for Testing Materials, 1916 Race St., Philadelphia 3, at $1.00 each, bound in a heavy paper cover.

Bolting Specifications

Modern Steel Bolting for Piping and Pressure Vessels was first presented as a paper before the seventh annual American Society of Mechanical Engineers, Petroleum Division Conference in Kansas City, Mo., September 1952. Authors are C. M. Vogrin, Frank S. G. Williams and John S. Worth.

Now reproduced in booklet form, it describes in detail the proper selection of bolting materials. Comments on each ASTM specification are given plus tables on the compilation of properties and bolting selection. Also included is a discussion on the behavior of bolted flanged connections of the types used in piping and pressure vessels.

Copies are available from the Taylor Forge & Pipe Works, Box 485, Chicago 90.

Guide for Instrument Mechanic Training

The Instrument Society of America recently has published a 60-page outline for the operation of an instrument mechanic training program. Entitled *Industrial Instrument Training Course Outline*, the paper bound publications cover such aspects of training programs as selection of mechanic personnel, instructor's suggestions, physical equipment, reference books and films, and a detailed outline of training materials according to the subject.

Some of the programs covered are: fundamentals of mechanics and electricity; theory and practice in operation and maintenance of electrical, mechanical, pneumatic, hydraulic and electronic instruments.

Copies may be secured, at 75 cents to ISA members and $1.50 to non-members, from the Instrument Society of America, 1319 Allegheny Ave., Pittsburgh 33.

I.C.S. Text on Refrigerating Machinery

A new text on *Management of Refrigerating Machinery* now is included in International Correspondence Schools courses in Refrigeration, Refrigeration and Air Conditioning and Stationary Refrigeration.

Subjects covered in this new text are: starting of compression plants, operation of compression machinery and its maintenance, management of "Freon" plants, types of bearings and bearing troubles and remedies. Illustrations of compressors with descriptions of operation are included.

The new book is also available under the I. C. S. Selective Plan which permits employers to select only those subjects required to achieve specific training objectives for certain personnel.

Publishers are the International Correspondence Schools, 1001 Wyoming Ave., Scranton 9, Pa.

Gas Technology Home Study Course

The Institute of Gas Technology is extending its educational services to the gas industry by bringing instruction, through home study courses, to students and utility

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Sanding soldered joints

Grinding welds, shearing bolts

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B&D PORTABLE GRINDERS prepare surfaces for welding; smooth welds; cut off rivets, bolts and studs; remove rust, paint; clean metal with wire-wheel brushes. 5" and 6" wheel diams.

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WEBSTER KINETIC* BURNER

For Low Pressure Gas

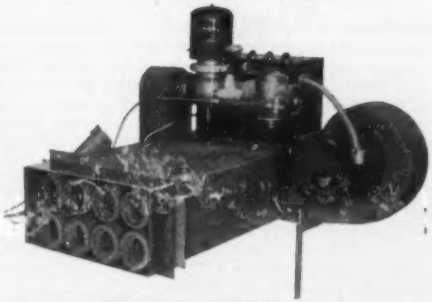
The Webster Kinetic consists of a multiplicity of full venturi mixers with flame retention nozzles. These are assembled in a metal casing complete with pilot and louvre. It may be used with natural, mixed or liquefied petroleum gases. Standby oil burners may be used when desired. As a multiple head assembly it is available in 25 standard sizes of from 4 heads to 48 heads, and can be supplied in any size or shape. Natural gas input ratings from 560,000 Btu/hr to 6,720,000 Btu/hr at 4" wc.

For complete information request Series B8 Bulletins.

WEBSTER DYNETIC*

Forced Draft

GAS BURNER



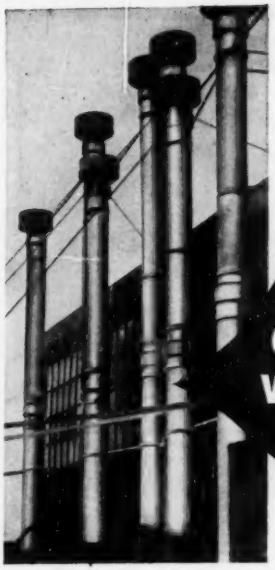
The WEBSTER DYNETIC Gas Burner consists of multiple venturi tubes with heat resistant alloy, flame retention nozzles assembled in a metal housing and equipped with an electrically driven blower to furnish all of the air for combustion.

All of the valves and controls required for safe, automatic operation, except for thermostat and limit controls, are incorporated in the assembly and wired and tested at the factory. The motor driving the blower is equipped with a centrifugal switch to prevent main gas valve operation unless the blower is functioning.

The burner is available in six sizes for natural gas.

*TRADEMARK

The WEBSTER ENGINEERING COMPANY
TULSA, OKLAHOMA
Division of SURFACE COMBUSTION CORPORATION, Toledo, Ohio



18 YEARS OF TOUGH VENTING HAS PROVED . . .

. . . TRANSITE* INDUSTRIAL VENT PIPE *lasts longer*

Transite Industrial Vent Pipe is known to many users for its exceptionally long service life. In lines where aggressive gases, fumes and vapors are present, it has proved itself time and time again. Maximum corrosion resistance is imparted to asbestos, cement and silica during manufacture which includes a special Johns-Manville steam curing process. Transite has paid for itself, sometimes over and over again, on many installations.

In addition, Transite Industrial Vent Pipe cannot rust. It needs no painting or other protective treatment. It has been used as ducts, vents or stacks for 15 to 20 years and longer . . . remaining in excellent condition . . . outlasting other material by a wide margin. (Transite has served the factory shown above for 18 years.)

Transite is light in weight and easy to handle. It can be cut and drilled with ordinary tools. It comes in a complete range of sizes up to 36" in diameter. A full line of corrosion-resistant Transite fittings makes it adaptable to practically any job requirement.

For further details on Transite Pipe for your venting problems, simply fill out and mail the coupon to Johns-Manville, Box 60, New York 16, N. Y. In Canada: 199 Bay Street, Toronto 1, Ontario.

*Transite is a registered Johns-Manville trade mark

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TRANSITE
Industrial Vent
PIPE

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Box 60, New York 16, N. Y.
Gentlemen: For facts about longer-lasting vent pipe, please send me Data Sheet Series DS-336.
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LOW PRESSURE SYSTEM

Condensate Pumps

Low Return Connection
Low Speed, Long Life
Cast Iron Receiver
Low Water Line
Single or Duplex

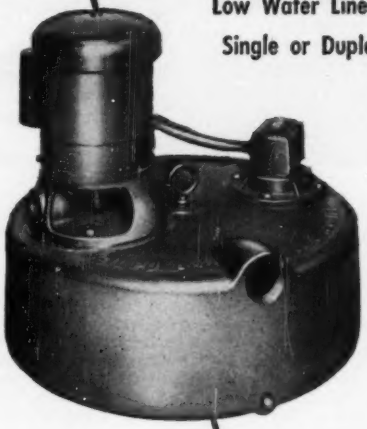

Fig. TVC 118
Single TVC unit

Capacities from
500 to 10,000 Sq. Ft. E.D.R.

Ask for
Bulletin TVC 300

Available from
JOBBERS' STOCKS

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employees. The courses are being prepared in cooperation with the American Gas Association. The first of the courses, *Natural Gas Production and Transmission*, was authored by Joseph D. Parent, dean of the Institute. Enrollments were being accepted after November 15.

The courses have been planned so that the subject matter can be understood by persons with little or no training in the fields under discussion yet they are sufficiently comprehensive so that they can be used as refresher courses for more experienced personnel.

This first course begins with the chemical, physical, engineering and geological fundamentals and then progresses to production, gas conditioning and transmission. Economic and legal aspects of certain operations are discussed and the closing chapters contain information essential to an understanding of the business activities of natural gas companies.

The work is printed in eight sections of two chapters each, with a ninth section containing Chapter 17 and an index. More than 170 photographs, drawings, flow diagrams, graphs and charts are included.

Libraries, schools, companies and individuals may purchase the texts at $37.50 from the Institute of Gas Technology, 17 W. 34th St., Technology Center, Chicago 16.

OTHER BOOKS AND REPORTS

PLASTIC PATCHING FOR STEEL PIPING — published in the June 1952 issue of the Bureau of Ships Journal. Written by Thomas W. McConville, CDR, USNR, Damage Control Branch, Bureau of Ships, it covers an emergency technique for repairing holes in steel pipe lines carrying gases or liquids evolved by the Navy's Damage Control Training Center. This procedure consists of placing a glass cloth patch over the hole and securing it with a wrapping of glass cloth tape. An active resin applied to the glass cloth and tape generates its own heat and thus sets the entire patch into a rigid mass which is said to withstand pressures up to 300 psi.

Copies of the Bureau of Ships Journal are available from the Government Printing Office, Washington 25, D. C., at 20 cents a copy.

INTERCHANGEABILITY OF OIL GAS AND NATURAL GAS, Institute of Gas Technology, by D. L. Nicol, R. A. Brown and H. R. Linden is an interim report on studies concerned with improving the substitutability of oil gases for natural gas through modifications of their composition. The three techniques covered are: mixing or dilution with inerts; reduction or removal of specific aromatic hydrocarbons through scrubbing, freezing or compression, and control of severity of cracking in the production of oil gases. Research was sponsored by the American Gas Association.

The 28-page report is available from the Institute, Illinois Institute of Technology Center, 17 W. 34th St., Chicago 16, at $2.50 a copy.

METALLURGY FOR ENGINEERS: CASTING, WELDING, AND WORKING, by M.I.T. professors John Wulff, Howard F. Taylor and Amos J. Shaler, is a guide to the proper selection, uses, and processing of metals.

This 624 page book is available from the publisher, John Wiley & Sons, 440 Fourth Ave., New York 16, at $6.75 a copy.

Kathabar

MAINTAINS IDEAL PRODUCTION WEATHER IN YOUR PLANT—EVERY DAY —YEAR ROUND.

"I'VE GIVEN MY CUSTOMER True Comfort Conditions of 78 F, 45% R.H. EVERY DAY NOW, FOR 11 YEARS"

A PROFITABLY satisfied customer and pleasant working atmosphere go hand-in-hand in Toledo Scale's engineering and drafting room above.

"ONE OF MY WELL SATISFIED customers, Toledo Scale Co., demands quality in all his purchases. He received quality with his first Kathabar humidity conditioning system, and bought a second.
"I'VE NOTICED my other customers since then. They're reluctant to compromise; they're impressed with Kathabar's plus values. Here are a few of *my sales advantages and customer-holding features:* rigidly-maintained comfort conditions—78F and 45 R. H.—just as continuously accurate as those for processing; dry coils; no shock, no chill; no carry-over."

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SEND FOR the Kathabar Engineering File Folder. Get ideas on how to install air conditioning equipment profitably.

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☐ Send me the Kathabar Engineering File Folder.
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114 115 116 117 118 119 120 121 122 124 125 126
127 128 129 130 131

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City ..... Zone ..... State .....

RECENT TRADE LITERATURE

For your convenience in obtaining copies of these bulletins, see coupon on this page. If you write direct to the manufacturer, describe fully what you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning.

Air and Gas Mixer

HPAC 101 — Bulletin L-700 describes "Vari-Set" mixer with a built-in adjustable air jet and venturi throat. Various types of assemblies are illustrated and drawings show dimensions and specifications. A detailed chart shows capacity ranges. [Manufacturer: Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.]

Boiler-Burner Systems

HPAC 102 — Thirty-two page, "Installing and Servicing Manual," gives instructions for hot water heating systems and hot water supply boilers. Photographs, diagrams and cut-away views show internal construction. Detailed specification charts on household and heavy duty units are included as well as a section that tells how to correct common boiler troubles. All parts and their functions are explained, with illustrated instructions on their operation and adjustment. [Manufacturer: Aldrich Co., 105 Williams St., Wyoming, Ill.]

Circuit Breakers

HPAC 103 — Manual 101 explains operating principles of basic circuit breaker designs and provides engineering data on factors of application. "What You Should Know About Circuit Breakers," includes simplified diagrams showing the three basic types of circuit breakers in general use with brief descriptions. Colored charts and diagrams explain temperature features, inrush current effects, tripping and reset time and time delay curves. Also discussed are wire deterioration rates at various ampere values.

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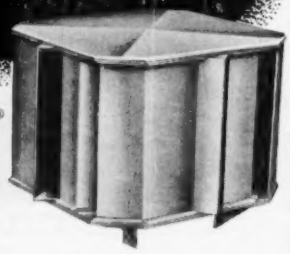

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WIND-ACTUATED
EXHAUSTERS

No Power Costs . . . No Maintenance
Perform Efficiently Regardless of Wind Direction

Now . . . with Agitair Exhausters, a hole in the roof becomes a complete ventilating system. Yes . . . every gentle breeze can be put to work to provide positive, adequate ventilation. Agitair Wind-Actuated Exhausters draw hot, stale air, steam or odors from the area being ventilated . . . regardless of wind direction or velocity. They prevent back-drafting, and are completely weatherproof under all conditions.

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AIR DEVICES, Inc.
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Air Diffusers • Air Filters • Roof Exhausters

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Power Fixed and Squirrel Cage
FANS

POWER FIXED FANS

Backward curve blade type with non-overloading characteristics. Housings constructed of steel plate and reinforced with heavy bracing angles. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia. Class I or Class II construction for better fan selection.

SQUIRREL CAGE FANS

Fan wheels have low speed characteristics. The low air velocities permitted are conducive to efficient operation. Housings are rugged and compact. Wheel sizes Single Width 13½" to 86½" dia. Double Width 18" to 86½" dia.

Housing shown above for 86½" wheel

Write for catalogs.

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The BISHOP & BABCOCK Mfg. Co.
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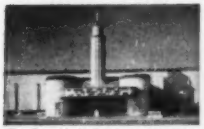
THEY SAY:
"It's Air Conditioning at its very best"

One of many modern pharmacies that depend on Ready-Power.

More and more super markets are using Ready-Power.

The "Frida," a Banana Boat, is Ready-Power equipped.


The Casa Linda theatre saves many dollars with Ready-Power.

Ready-Power air-conditioning is ideal for churches

Wherever used, Ready-Power has met the test of operating efficiency to the full satisfaction of the user.

Ready-Power air conditioning equipment is planned and designed to meet the most exacting requirements with the lowest possible operating costs.

Ready-Power design permits *continuous* operation at varying speeds, which is far superior to "on and off" types. This means that the air conditioning system performs at reduced capacity allowing for a constant dehumidification of the fresh air supply.

The dependable and economical performance of Ready-Power has been proved in hundreds of installations. Names of users will be furnished on request.

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Manufacturers of Gas and Diesel Engine Driven Generators and Air Conditioning Units; Gas and Diesel Electric Power Units for Industrial Trucks.

Your Heating Problem is Our Business

M&L ...Traditionally the right equipment for every Water Heating purpose

When your plans include heating water with live or exhaust steam—when they call for hot water supply to radiant heating panels or other hot water systems—then use M & L equipment.

There are many reasons why M & L equipment is traditionally selected for dependable, uninterrupted service—one of which is the extreme care exercised in assembling, to insure longer service life.

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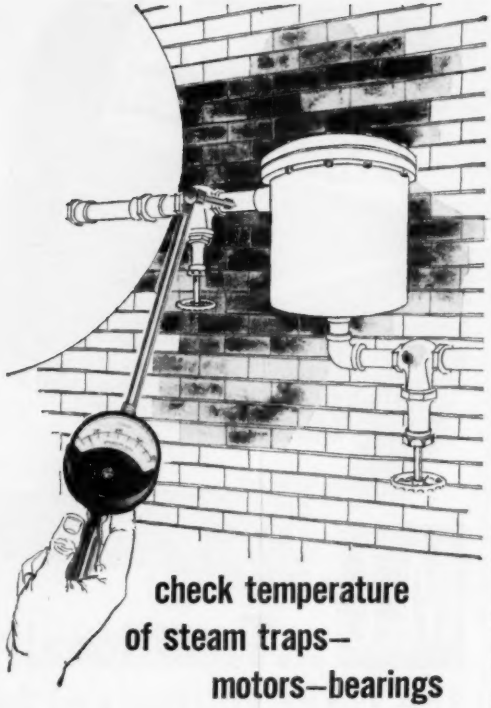

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[Manufacturer: Heinemann Electric Co., 549 Plum St., Trenton 2, N. J.]

Compressors and Condensing Units

HPAC 104 — Eight-page bulletin, DB 101-160, describes hermetically-sealed refrigeration compressors and condensing units of 75 to 100 hp capacity. A brief table of specifications gives technical data on two sizes of compressors. The standard electrical characteristics are also given. Two pages of line drawings give overall dimensions of both compressors and condensing units. [Manufacturer: Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36.]

Condensation Control

HPAC 105 — Data Sheet 000-8 describes a temperature relation controller which keeps the temperature of stored material above the dew point of the air. This automatic control system measures the air temperature and the dew point of the air. When the temperature of the material approaches the dew point, the instrument positions valves in the heating system to prevent moisture formation. [Manufacturer: Foxboro Co., 106 Neponset Ave., Foxboro, Mass.]

Dehydration Equipment

HPAC 106 — Twelve-page bulletin describes the needs for dehydration and the extent to which gas or air can be dried, practicably, together with the operation of specified equipment. Three series of dehydrators are fully specified as to capacities and physical dimensions. A nomograph is provided for preliminary determinations of appropriate equipment. A separate data sheet with spaces for more specific operating information is included. [Manufacturer: Selas Corp. of America, Philadelphia 34.]

Driers for Refrigerants

HPAC 107 — Bulletin 700 introduces new line of driers. Complete specifications, descriptions and illustrations are included for various types including non-refillable type, bulk refill type flanged driers, refill cartridge type flanged driers and angle refill cartridge type. [Manufacturer: Henry Valve Co., 3215 North Ave., Melrose Park, Ill.]

Expansion Joint Design

HPAC 108 — Sixteen-page illustrated catalog describes various types of corrugated expansion joints and the basic theory behind expansion joint design. Catalog CMH-127R gives complete specification and installation information. Also covered are dual, hinged, balanced and bulkhead units. [Manufacturer: Flexonics Corp., 1396 S. Third Ave., Maywood, Ill.]

Flexible Tubing

HPAC 109 — Catalog C2-3 describes uses and construction of flexible tubing. Also included is information on tubing for special applications, and on fittings. [Manufacturer: Flexible Tubing Corp., Guilford, Conn.]

Fuel Oil Heater

HPAC 110 — Bulletin 60 L offers information on the new "Paracoil Type GF" indirect gas fired fuel oil heater. Steam or hot water boilers are not essential in the operation of a No. 6 oil system. The new

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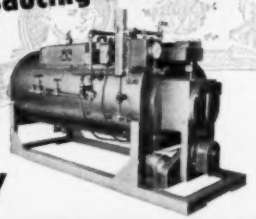

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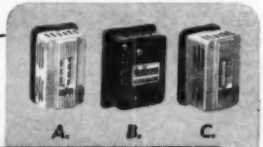

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oil heater provides its own supply of steam using gas fuel as the primary source of heat energy. The bulletin gives a description of the theory of design and operation of the heater. Piping diagrams, capacity charts and design specifications are also included. A table giving the comparative costs of heating No. 6 fuel oil using electricity, gas and oil as the heating media forms part of the engineering data. [Davis Engineering Corp., 1064 E. Grand St., Elizabeth 4, N. J.]

Gas Fired Unit Heaters

HPAC 111 — Four-page technical bulletin describes expanded line of Series 23 gas fired unit heaters. The new line, according to Bulletin 23-2, includes a number of sizes with Btu capacities from 55,000 to 400,000 per hr. A newly designed line of blower heaters, approved for use with ductwork, is also featured. Included in the booklet are capacity tables and roughing in dimensions for the unit heater line. [Manufacturer: United States Air Conditioning Corp., 33rd and Como Aves., S.E., Minneapolis 14.]

High Velocity Systems

HPAC 112 — "Aspiration," an air conditioning quarterly, discusses high velocity aspirating units in the latest issue. Design criteria and technical data on duct design are included. [Publisher: Anemostat Corp. of America, 10 E. 39th St., New York 16.]

Hospital Ventilation

HPAC 113 — Bulletin 1510, "Modern Practices in Hospital Ventilation," describes ventilating equipment installed in hospitals throughout the country. Each item is illustrated and applications are shown for use of this equipment in every part of the hospital. [Manufacturer: Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago 41.]

Hot Water Control

HPAC 114 — Data sheet, "Hot Water Temperature Control," discusses the various methods of supply hot water to the occupants of apartment houses, hotels and office buildings. It describes the procedures and equipment that may be used to maintain the temperature of water in the proper range so that overheating is avoided. [Publisher: Water Service Laboratories, 423 W. 126th St., New York 27.]

Industrial Fans

HPAC 115 — Eleven sizes of industrial fans and their standard wheels are described in Booklet SA-6873. A table of condensed specifications on performance and dimensions and a table of maximum operating rpm's for various fan sizes and operating temperatures are presented. In addition, the booklet discusses each of the three available wheel types and gives typical applications for each. Accessories and special features are pointed out. [Manufacturer: Westinghouse Electric Corp., Sturtevant Div., Dept. T-415, 200 Readville St., Hyde Park, Boston 36.]

Insulation Installation

HPAC 116 — Information on cost-reducing methods of installing all types of insulation material combined with information on the "Nelweld" method is included in a

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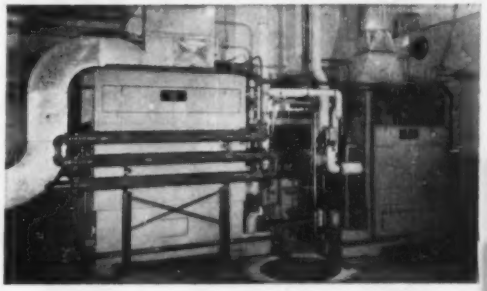

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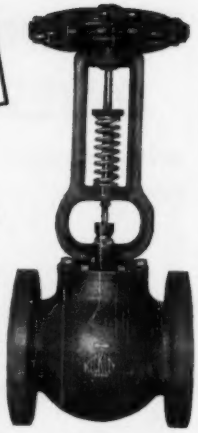

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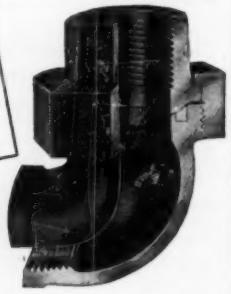

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35-page booklet. Detailed information, complete with pictures and diagrams, is included on the various types of end-welded studs for use with various types of insulation. Application procedures are given for each type of stud fastener for use in four different material groups. Complete information is given on the methods for supporting reinforcing materials used with gunite. Generators and battery units also are described. [Manufacturer: Nelson Stud Welding, Div. of Gregory Industries, Inc., Lorain, Ohio.]

Liquid Filters

HPAC 117 — Illustrated Bulletin D-IL contains specifications, engineering and performance data, photos and descriptions of recommended types of filter media and a check list of liquids that can be filtered. A special feature is a bound-in data sheet to be filled in by the prospective customer and which can be torn out of the bulletin and mailed directly to the manufacturer. [Manufacturer: Dollinger Corp., 11 Centre Park, Rochester 3, N. Y.]

Metal Framing and Pipe Supports

HPAC 118 — Pocket-size catalog, No. 800, contains ideas, photographs, drawings and data on how to frame, hang, mount and support mechanical and electrical equipment with adjustable metal framing. Also included are reference tables, graphical symbols and data covering weights and dimensions. [Manufacturer: Unistrut Products Co., 1013 W. Washington Blvd., Chicago 7.]

Oil Booster

HPAC 119 — Bulletin AD-108 points out features of new "Peak-Temp Oil Booster." Specifications of the heating element, shell fittings and oil burner equipment are included. [Manufacturer: Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee 12.]

Perforated Materials

HPAC 120 — Catalog contains photographs of various style perforations in actual use, such as a machine guard or acoustical ceiling. With every photograph is an illustration showing the exact size and style of the perforation used in that particular installation. Directions are included on how to measure perforations. [Manufacturer: Erdle Perforating Co., Inc., 177 York St., Rochester 11, N. Y.]

Potentiometer

HPAC 121 — Specification Sheet 179 give full details of "Electronik" strip chart potentiometer with two second full scale pen travel. Drilling and mounting dimensions are included. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Philadelphia 44.]

Pump Specifications

HPAC 122 —Revised four-page Bulletin G-52 covering line of pumps including agricultural, construction, sprinkler irrigation, general industrial, waste disposal and petroleum types. Designed as a review and reference bulletin, the new brochure contains pictures of representative units and general descriptive matter covering each type. [Manufacturer: Marlow Pumps, Ridgewood, N. J.]

Radiator Heating

HPAC 123 — Catalog R52 contains portraits, cut-away

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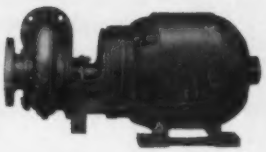

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Registers and Grilles

HPAC 124 — Catalog No. 52 gives complete specifications as to weight, size, finish and applications of the company's line of registers and grilles. Several detailed selection tables are included. [Manufacturer: The Independent Register Co., 3747 E. 93rd St., Cleveland 5.]

Regulating Valves

HPAC 125 — Bulletin 535 contains diagrammatic drawings of steam pressure regulating valves plus dimensional data and construction details. Similar information is included for three new items, Type F, FR and PR. Several sizing tables are also included and one section discusses how to choose regulating valves. [Manufacturer: D'Este Div., Kaye & MacDonald. Inc., 11-15 Central Ave., West Orange, N. J.]

Silver Brazing

HPAC 126 — "A Complete Guide To Successful Silver Brazing," discusses low temperature silver brazing, brazing alloys, joint design, preformed brazing shapes, plymetals, fluxing, heating methods, and cleaning and inspection.

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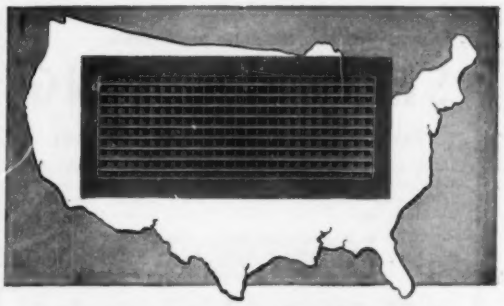

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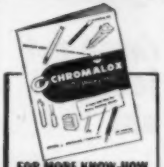

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50-20

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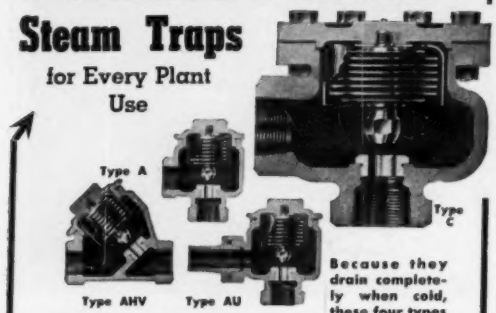

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BULLETIN 152
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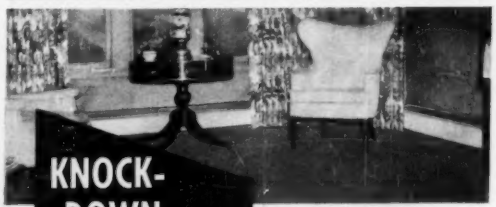
Reference charts for selecting specifications for silver brazing alloys are included. Also there is a special graph used to calculate the thermal expansion of metals at various silver brazing temperatures. The 48-page manual is illustrated. [Publisher: American Platinum Works, 231 New Jersey Railroad Ave., Newark 5.]

Slip Stem Valve

HPAC 127 — Type 31 double-seated, slip stem regulating valve is fully described and illustrated in a four-page specification sheet, 422. Covered are straight-through and angle type positions for either lever-and-weight or lever-and-float operators. Pertinent data such as size, construction, body-temperature ratings and complete mounting dimensions are given. Also included is complete ordering data. [Manufacturer: Minneapolis-Honeywell Regulator Co., Brown Instruments Div., Wayne and Windrim Aves., Philadelphia 44.]

Temperature Recorder

HPAC 128 — Bulletin 447 contains complete details of temperature recorder construction, showing how each component part, from bulb to chart, contributes to accuracy. One section is devoted to selecting the correct thermal systems for temperature measurement applications. Actual installations are pictured and complete descriptions are provided for rectangular and circular case instruments, temperature bulbs, charts and accessories. A brief description of indicating and controlling temperature instruments also is included. [Manufacturer: Foxboro Co., 106 Neponset Ave., Foxboro, Mass.]



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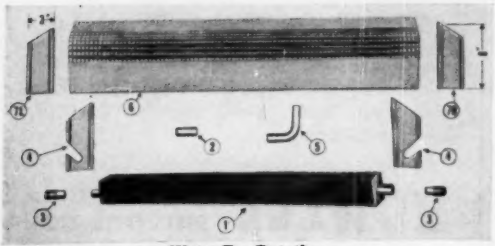

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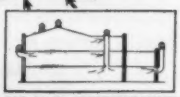

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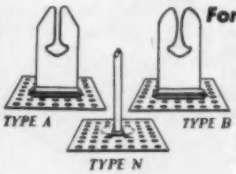

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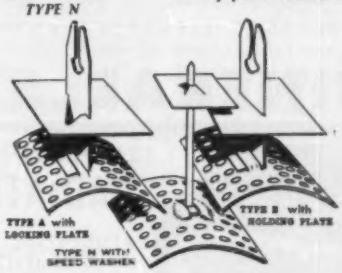

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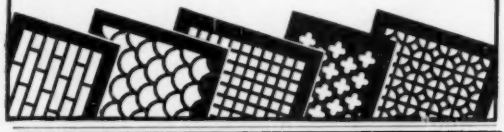

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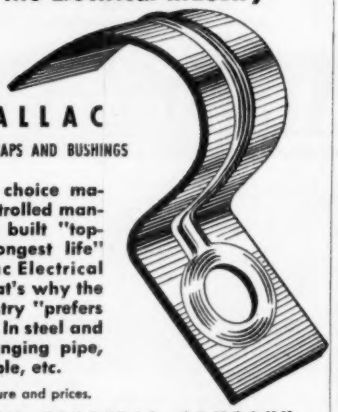

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HPAC 129 — New 68-page condensed catalog No. 301, "Tools of Industry," contains illustrations, descriptions and complete information about the company's entire line. Some of the products featured include carbon and alloy wrenches, detachable sockets, impact sockets, tool holders, lathe dogs, chain pipe tongs and vises. [Manufacturer: J. H. Williams & Co., 400 Vulcan St., Buffalo 7.]

Unit Heater

HPAC 130 — Catalog introduces new "327" line of gas-fired unit heaters. The new unit, featuring small size and quieter operation, is illustrated with line drawings and photographs showing typical installations. Information is included for the installer. [Manufacturer: Bryant Heater Div., Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10.]

Unit Heater Ratings

HPAC 131 — The Btu output ratings for various models of 30 different makes of unit heaters are listed in a new 8-page Bulletin No. 231. This bulletin tells how to figure condensing rates, how to select unit heater traps and gives hints on unit heater trapping. Included are tables for selecting traps for constant pressure and varying pressure operation, and a table of constants for determining output of unit heaters at other than standard steam pressures and entering air temperatures. There is also a chart for determining heater outputs at various fan speeds. Physical data, capacities and prices of the company's traps are given. [Publisher: Armstrong Machine Works, 874 Maple St., Three Rivers, Mich.]

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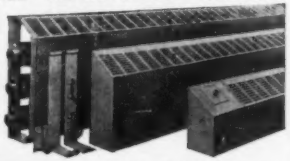

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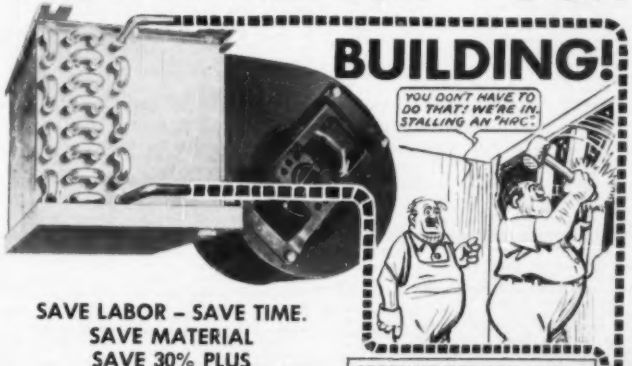

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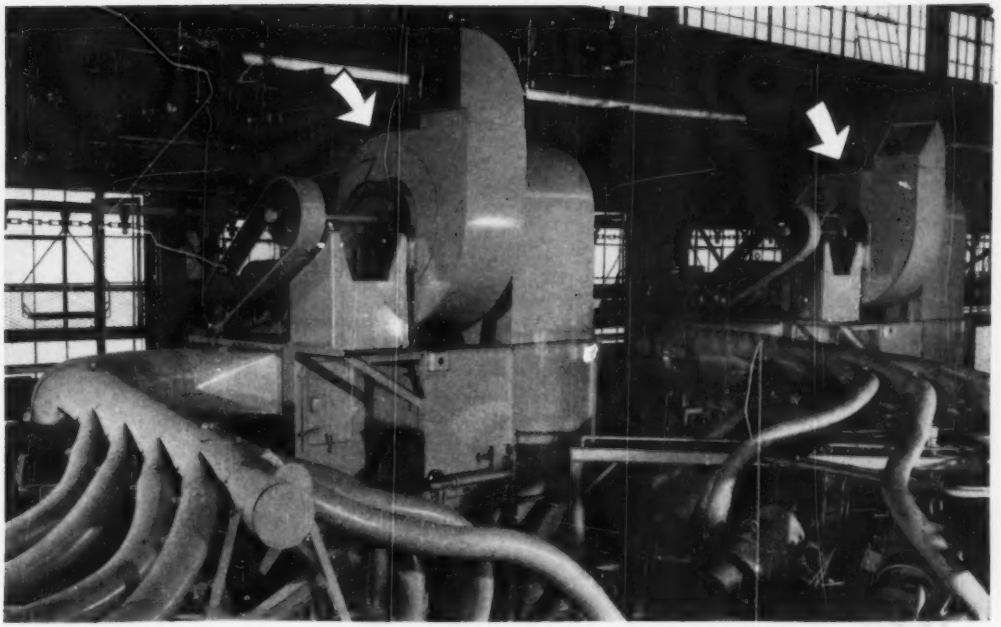

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are users of Clarage equipment . . . This wide acceptance denotes the high quality and reliable performance of Clarage products.

Above you see two of the twelve Clarage Improved Exhausters on a vital-to-production dust collecting job in the Monroe, Michigan plant of the Ford Motor Company.

These twelve fans operate in connection with twelve American Air Filter Company's Roto-Clone installations.

Ford Motor Company has used Clarage equipment for over a quarter century.

Counting all of this Company's plants, well over a thousand Clarage fans are now handling the many and varied air handling requirements of this leading automotive and defense materiel manufacturer.

You can RELY on Clarage equipment to give you economical service for a long time to come. CLARAGE FAN COMPANY, 627 Porter Street, Kalamazoo, Michigan.

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Headquarters for Air Handling and Conditioning Equipment

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WHO WOULD DARE TO GAMBLE WITH HER SAFETY?

On one thing everyone is united: protection of the school age youngster. Woe unto the man who would gamble on the safety or health of the boys and girls who hold the promise of tomorrow!

But despite the fact that old America is solidly united on the need for protecting young America, some hazards, less obscure but no less real than traffic, fire or health dangers, are sometimes overlooked.

An excellent example is the unprotected heating or power boiler in school buildings. It is the duty of every heating man to point this out to the proper authorities.

No field is more receptive to your counsel. No field offers you a better opportunity to be of real service to your community.

There are McDonnell safety devices for every type and size of heating boiler and hot water plant found in schools, operating at any pressure up to 150 lbs. A number of them are illustrated here. Ask for complete catalog.

McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.

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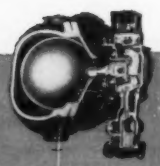

McDONNELL No. 51-2 Feeder control combination for the larger boilers above 3000 sq. ft. capacity; max. steam pressure, 35 lbs. No. 51 (without switch) for hand-fired boilers. Similar types for smaller low pressure boilers.

No. 67 Low Water Fuel Cut-off for automatically fired boilers of any size; maximum steam pressure, 30 lbs.

No. 150 Pump control, low water fuel cut-off and alarm switch for higher pressure boilers (maximum steam pressure 150 lbs.)

No. 33 Safety Relief Valve for hot water heating boilers. Rated and labelled capacity 242,900 Btu. per hour — sufficient to prevent over-pressure under all conditions in 70% of hot water heating jobs.

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Your Jobber Stocks Them

McDONNELL *Boiler Safety Devices*